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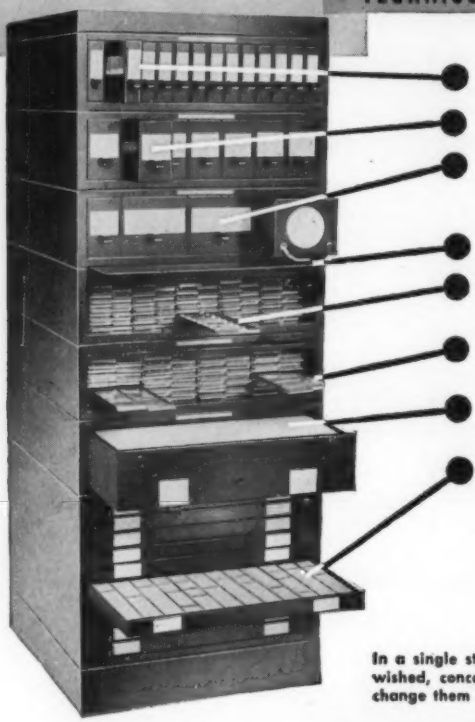

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Psychology

ONE of the most stimulating but controversial areas of contemporary psychological endeavor is that termed "action research," or "group dynamics." The work in this field is stimulating in that it attempts to deal with the almost untouched problems of social therapy and social change. It is controversial because it deals boldly with areas science has hitherto been hesitant to enter, and because its workers, instead of remaining "outside" the interactions of their experiments, often serve as "participant observers"—that is, they themselves become research variables.

Although there are available several definitions of action research, perhaps a consideration of the vocational activities of the action researcher will prove more illuminating. Working on the boundaries of social, clinical, and industrial psychology, as well as sociology and cultural anthropology, the action researcher considers leadership in its many aspects; what makes for cohesiveness among living groups; how to make discussion, industrial, and other groups function more effectively and productively; how to relieve national, racial, economic, and other group tensions; and how to change attitudes, opinions, and habits of action.

The action researcher utilizes many scientific tools, but he also employs some radically different techniques. One of the latter, termed sociodrama or role-taking, illustrates the newer methodologies. If, for example, the action researcher takes as his problem the reduction of friction found to exist between white and Negro students of a certain high school, the scheme of social therapy he will follow might prove to be something of this nature: Members of both racial groups would be asked to act out as realistically as possible some tension-producing situation. Drama roles would be assigned arbitrarily, with the experimenter as a possible participant. At first, perhaps, the whites might be assigned white roles, and the Negroes, Negro roles. Later the roles might be exchanged, so that members of one race might better experience the tension-producing stimuli surrounding the other.

Action-research studies on problems associated with group decision lead to conclusions quite contrary to what has rather generally been held in the past. They show that lectures by experts tend to be inferior to discussion in changing attitude and nonsymbolic activity. Thus, if one wants to alter the food habits of a group, it seems wise to avoid the exhortations of experts. A better procedure would appear to be that of bringing the group together for intimate discussions of the subject. It is assumed, of course, that the members will have ready access to pertinent informative materials.

It is difficult to appraise this new field of action research. Indeed, many a psychologist still regards the work as only quasi-scientific, but the movement is still very young. It was born only a few years ago at MIT, where a group of social psychologists began work under the guidance of the late Kurt Lewin. Now there is a flourishing Research Center for Group Dynamics at the University of Michigan, and each summer the National Training Laboratory, of Bethel, Maine, schedules increasingly popular workshops on action research.

Perhaps a quotation from the Bethel Laboratory's prospectus will reveal the uniqueness of action research, this strange blend of research and attempts at social change.

> Usually research is set apart and there is a wide gap between researchers and action people. At the Laboratory, however, training leaders and participants play a part in research projects, and research workers play a part in training plans. Thus, action leaders have the opportunity to see the place of research in action programs, and to learn the use of research methods in a practical situation. Research workers have an opportunity for data collection on both short-term and long-range research projects on group behavior, which meets the demands of the training purpose.

PAUL R. FARNSWORTH
Department of Psychology
Stanford University

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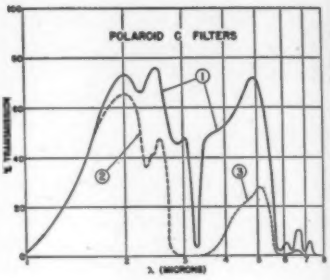

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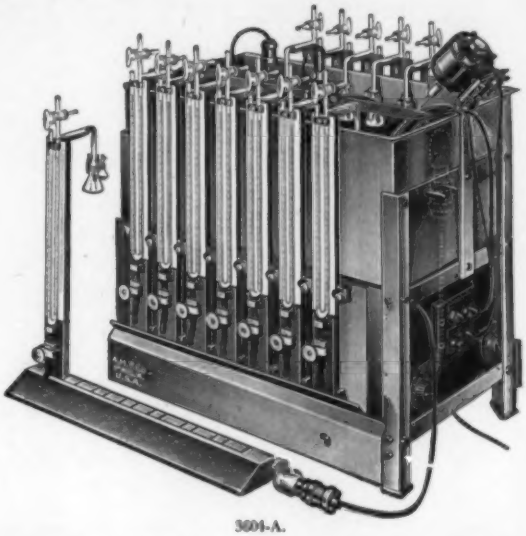

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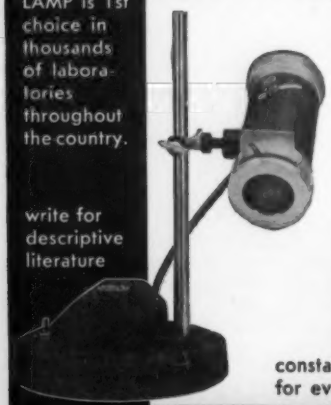

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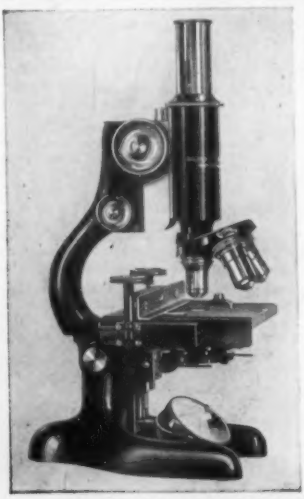

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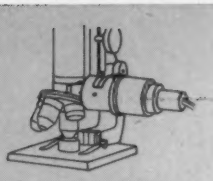

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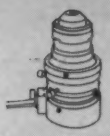

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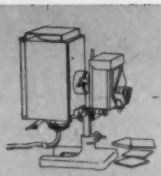

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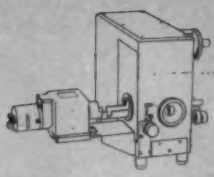

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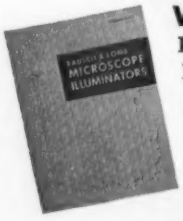

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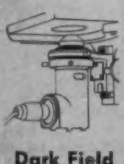

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The Status and Development of Biophysics

Comments and Communications

Most physiologists must have been keenly interested in the thoughtful and provocative article by R. W. Stacy on "The Status and Development of Biophysics" (*Science*, **113**, 169, [1951]). A thorough discussion of this frequently mentioned but rarely understood field of science has long been needed. Indeed, we feel that the very thoroughness of Stacy's presentation makes clear the weakness of his point of view.

Perhaps the most vulnerable statement in his article is the assertion that "Any physiologist will concur in the idea that his field embraces the physics and chemistry of living matter." This writer, as a physiologist himself, can testify to the inaccuracy of this statement. It has been many years since "physiological chemistry" started to sprout away from the parent physiology. The field of biochemistry has grown to its full maturity and most certainly deserves to stand now as an autonomous member in the broader field of the biological sciences. We believe that relatively few physiologists would continue to regard biochemistry as a subdivision of physiology. Those who, like Stacy, continue to place it in this category can be completely overbalanced by the vast majority of biochemists who, while in no sense denying their heritage, would refuse to recognize a continued allegiance and subordination to physiology. It must therefore be recognized that the "chemistry of living matter" is no longer encompassed within the scope of modern physiology.

There are certain phases of physiology that are not strictly physical. A good example is the physiology of the kidney, for renal physiologists are still actively engaged in the task of defining how much of kidney function is dependent upon physical processes of filtration and diffusion, and how much is based upon the strictly biochemical processes involved in active reabsorption and secretion. There is little doubt that, as soon as renal physiology has advanced to the point where its biochemical aspects have been clearly defined, these aspects will be dissected free and taken over by the biochemists. As another example, most physiologists tend to regard endocrinology as still being a subdivision of physiology, although this point of view would certainly be challenged by the biochemist.

Many chemical aspects of physiology are essential to a proper treatment of the physics of living matter. Thus the broader aspects of nutrition and total metabolism must be considered in an analysis of the energetics of living systems. The study of inorganic anions and cations is much more closely related to the physical side of physical chemistry than to chemical reaction systems. At present certain aspects of the chemistry of choline compounds appear essential to an understanding of the electrical phenomena occurring in the body. While recognizing these fringe areas and overlaps, we believe that the field of physiology is rapidly approaching the point where it can be adequately described as "the physics of living matter."

This is well illustrated in Stacy's article. In elaborating the scope of biophysics, he states that "The biophysicist should devote himself to physical measurement of the three basic phenomena of circulation: pressure, volume of flow, and velocity of flow." This would leave nothing in the circulation for the physiologist to worry about except such problems as the electrical changes associated with heart excitation, the sound vibrations associated with heart action, and the function of the circulation to the skin in determining the exchange of heat between the body and its environment. Yet certainly the latter aspects would also be encompassed in Stacy's concept of biophysics. Similarly, Stacy lists the "physics of gases" as of concern to the biophysicist interested in respiration. Again we find his concept synonymous with respiratory physiology. Stacy in studying the "biophysics" of respiration surely must devote just as much attention to the chemistry of hemoglobin and carbonic anhydrase as is now given in respiratory "physiology" to these areas of overlap. Similar reasoning is applicable to nerve physiology and its concentration on bioelectric problems, to muscle physiology and its focus on biomechanics, and to sensory physiology with its attention to physical stimuli derived from the environment. Up to this point, therefore, Stacy's argument would appear to be simply one for substituting a new term for the long-established term "physiology." Without debating the greater etymological accuracy of designating modern physiology as "biophysics," the necessity for rechristening such a well-established field is to our minds of doubtful value, especially when it is remembered that the name has already been usurped by many radiobiologists.

But Stacy makes it quite clear that his concept of biophysics goes far beyond modern physiology. He would extend its scope to encompass the "application of physical techniques to biological measurement." Here we find a point of view expressed which, to our minds, is shortsighted and lacking in any perspective as to the true nature of the problem. Indeed, Stacy makes it clear that he really does not mean "physical techniques" but rather is thinking in terms of physical gadgets of recent vintage and reasonable complexity. Thus he would specifically designate the biologist employing the electron microscope as a "biophysicist" and yet by inference he would exclude the vast array of biological scientists who employ the ordinary light microscope. Certainly the common light microscope is just as purely "physical" as is the electron microscope. Again, Stacy would identify the biochemist employing the infrared spectrophotometer as a biophysi-

cist. But have the physicists ceased to claim the visual wavelengths of the spectrum? It would appear that the ordinary photoelectric colorimeter, or even the simple visual colorimeter, is every bit as physical as is the infrared spectrophotometer.

In the physiological field, the characterization of what is meant by "physical techniques" becomes even less tenable. By way of defining the scope of biophysics in this field, Stacy points out that "instruments like the ballistocardiograph, electrokymograph, capacitance cardiometer, and electromagnetic flowmeter are physical in nature." But may we also point out that instruments like the simple mercury manometer, the stethoscope, the ordinary mechanical kymograph, the sphygmograph, and the optical membrane manometer are equally physical in nature. The only consistent difference we can see between the "physical techniques" cited by Stacy and the vast majority of physiological techniques that Stacy ignores is that the latter techniques were in general use prior to the year 1930. Surely the designation "biophysics" does not validly distinguish between these two phases of physiological technology.

As a more extreme example, we may cite one of the oldest and most classical experiments in physiology. As routinely employed in elementary courses, the student removes a muscle from the leg of a frog, mounts it upon a stationary support, connects the free tendon to a simple lever commonly represented by a bamboo straw, which in turn writes upon a smoked paper surface moved by an old-fashioned clockwork type of spring motor. To establish time ordinates, the student makes use of either an ordinary tuning fork or a simple electromagnet driven by some form of mechanical interrupter. The lever is provided with a hook to which may be attached weights, and the muscle is commonly stimulated with a simple induction coil. Here, certainly, is a "physical analysis of biological behavior" employing strictly "physical techniques to biological measurement." Yet many "biophysicists" would be horrified or even insulted to have such pursuits identified with biophysics. Even from Stacy's account, in which muscle mechanics are recognized as being within the scope of biophysics, we get the impression that this experiment would not be representative of biophysics unless the recording were made with a piezoelectric crystal or a variable reluctance transducer operating through a carrier amplifier to drive a cathode-ray oscilloscope.

The development of physical instrumentation is one of the profoundest advances in science in the past two decades. It has had the greatest impact upon the biological scientist because, as Stacy correctly emphasizes, the biologist has been the least competent to make intelligent use of this new armamentarium of instrumentation. The practical import of Stacy's position seems to be that this present inadequacy should be corrected by setting aside a certain group of biological scientists to become competent with, and to train others in, the biological application of this new instrumentation.

Such an isolationist policy we feel does not meet the problem squarely or offer a sound solution for the future. Many physiologists are already disturbed by the increasing number of instances where skilled technologists apply complex physical instrumentation to physiological problems in which an inadequate comprehension of basic physiology tends to be masked behind the elegance of their instrumentation. In basic research, technology must always be strictly subservient to the biological scientist, and at no point should instrumentation rise above, or even be considered upon the same level as, the fundamental concepts and implications of the biological material. What is urgently needed is that *all* biological scientists and most certainly *all* biological scientists-in-training recognize the utmost importance of acquiring enough grounding in physics so that they can make intelligent use of physical instrumentation in the future advancement of the biological sciences.

ROBERT S. ALEXANDER
School of Medicine
Western Reserve University

EVERY worker in the field of biophysics owes a debt of gratitude to Dr. Stacy for his timely article (*Science*, **113**, 169 [1951]). His remarks on the confusion that exists on the subject matter to be included in biophysics are very true, as anyone who has to teach the subject would testify. At the same time, I cannot help thinking that the source of the difficulties is to be found elsewhere.

To an experimentalist, biophysics must appear as an impenetrable jungle, but this does not dismay him for, in general, he is only interested in one particular kind of experimental problem. What is lacking in biophysics is a methodology, and this is a problem for the theoretical physicist.

In every textbook on physics one will find, sandwiched between mechanics and heat, a heterogeneous variety of topics such as surface phenomena, colloids, diffusion, viscosity, and others, which are generally included in "properties of matter," but which are not amenable to treatment by the same general laws that are so satisfying to the aesthetic soul of a physicist.

It is precisely in this field of open, irreversible heterogeneous systems that our present laws of physics are inadequate. Whether one follows Prigorgine in extending the second law of thermodynamics so as to free our concepts of entropy from the state restrictions of equilibrium and reversibility; whether one follows Wiener in denying the applicability of the second law to living systems and replaces it by a law of information based on ectropy or negative entropy; or whether, like Rashevsky, one abandons thermodynamics altogether, is not important. Whether a system of neural nets can be described in terms of Boolean algebra or by an electronic computing device, it is just as possible to understand the mechanism of the central nervous system, as Pitts and McCullough, who have had a foot in each camp, have shown.

As long as biophysics is a branch of physics, it

should be taught on the lines traditional to physics. It will be as different from the biophysics of a medical school as thermodynamics ("physical chemistry") would be.

DAVID POMEROY

Biophysics Laboratory
University of Florida

I HAVE read with great interest Dr. Stacy's article about the status and development of biophysics in the United States. May I point out that in my own country (France) medical students have long since been given regular courses in bio- or medical physics, and this during the second semester of each of their first two years of study.

Their program includes Bioenergetics—first and second principles of thermodynamics as applied to human beings; Study of Body Constituents—solids (biomechanics), liquids (circulatory system), gases (respiratory system); Physical Chemistry of Cells and Tissues—pH, Rh, capillary effects, viscosity, membrane phenomena, etc.; Hearing; Speaking; Vision; Electrophysiology, Diagnosis and Therapy—electrocardiography, electroencephalography, diathermy, short waves, electric shock therapy, etc.; X-Rays—production and quick survey of their utilization; Radioactivity—natural and artificial; quick survey of utilization.

A current textbook has been written by André Strohl, head of the Medical Physics Department of the Paris Faculty of Medicine and is entitled *Physique médicale* (Masson et Cie, pub.). Teachers in the field are appointed by the French Ministry of Education after a special competitive examination held every third year and called the *Agrégation*. Candidates must all be M.D.s and usually have a Doctor's or Master's degree in physics plus, of course, a fair clinical training. Unnecessary to tell that it's not often that one gets such a position before he is thirty years old.

JEAN CLAUDE ROUCAYROL

38 rue de Courcelles
Paris

THE breaking up of natural science into many fields of specialization has been forced upon us by the ever-increasing scope of knowledge. Such subdivisions develop traditional domains of interest and encourage research men to acquire special competence in particular modes of thought and methods of investigation.

Unfortunately, along with certain undeniable advantages in specialization, there are also very serious losses. Fields become separated by barriers of language and administrative convenience. Competition channels the research effort, discouraging collaboration and the interplay of ideas. Between these compartmented fields there remain almost untouched borderline problems. Virtual no man's lands are left behind in the precocious advance of science.

There can be no doubt that such a no man's land exists between physics and biology. Why? Chiefly because it is impossible in the conventional period of education to become adequately grounded in both physics and some fields of biological specialization. In order to bridge this gap the field of biophysics is being fostered by an increasing number of institutions. As yet there is no traditional domain, no well-developed audience for its publications, no established curriculum of prescribed education.

With understandable enthusiasm Dr. Stacy has attempted to call attention to this field and its problems. Unfortunately, he has failed to consider the latter from the standpoint of existing biological disciplines. Failure on the part of those who profess biophysics to exhibit a scholarly appreciation of the biological sciences will inevitably retard progress, because it encourages the attitude "Let the biophysicists do the instrumentation and the biologists do the thinking." No other concept of biophysics could be more fatal to the development of the field.

The driving motivation in any area of research must be curiosity and the desire to contribute to knowledge and understanding. If the brilliant minds needed in biophysics are to feel its challenge, it is the opportunity to exercise the imagination, to introduce new concepts and differing modes of analysis that will attract them.

Dr. Alexander has taken sharp issue with Dr. Stacy's definition of the biophysical field, and there is much merit in his views. No logical and well-defined demarcation can be offered that delineates biophysics from physiology. The difference is purely one of degree and emphasis. Every biophysicist must strive to be a good physiologist, as well as a good physicist. Within the scope of his research he must be well grounded in biology. Without biological perspective his work will betray the naïveté that has too often colored the work of physicists who have undertaken biological research. This is the reason so many of the capable biophysicists are those who obtained their biological training first.

For biophysics there must be adequate grounding in both biology and physics. It is of little moment which training precedes. Both are of equal importance. Few have the capacity and determination to encompass both fields. It is doubtful that a curriculum can be devised which will provide such training within conventional time limits. Probably it will always require additional years of study, as well as special abilities of intuition, analytical power, and judgment.

Biophysics overlaps not merely physiology, but also each of the other biological sciences. A borderline domain exists between physics and practically every field of biological specialization. A biophysicist can be guilty of poor cytology in electron microscopy, poor biochemistry in molecular investigations with infrared, or poor cell physiology in research on the biological action of radiation.

The staking out of claims has little merit. What we need is closer interchange of the *ideas* that develop so rapidly in each science. This can come only by comradeship and mutual respect. The fields that most intrigue me involve physical chemistry, as well as

physics and biology. To obtain complete mastery of all three is hopeless. We must ask the tolerance of our fellow-specialists in other fields and not hesitate to admit our limitations. It is through our discussions with them, as well as through our reading, that we can avoid the pitfalls of naïveté. I don't see how one divorces scientific fields without retarding progress toward understanding.

Physicists have a somewhat different philosophy of instrumentation than do most biologists. Their fields of inquiry generally require the development of new instruments for particular investigations, and often this requires years of effort before the imaginative return can be garnered. Frequently biologists interpret this as a primary interest in instrumentation. For the good physicist this is just as fatal as in any other field of research. He has simply become accustomed to a greater demand on his patience and perseverance. He must command different fields of technology to accomplish his research. Gadgeteering as an objective spells the end of research. If biologists are to encourage physicists to take up biophysics, they must avoid demanding too much technological assistance and must help the physicist acquire biological familiarity and perspective. The physicist must be prepared to do a great amount of reading and laboratory work before he can claim to be a biophysicist.

Biophysics differs from the biological fields on which it may impinge simply in:

1. The more advanced physical concepts that may be brought into play.
2. The kinds of information on mechanism that may be sought.
3. The background of interpretation which can be drawn upon.
4. The kinds of analysis employed.
5. The development of new approaches derived from a different experience.

It requires just as much biological perspective, judgment, and factual knowledge.

To Dr. Alexander I would say that those of us who have entered biological research from physics need your help, encouragement, and guidance through our fledgling stage; we do have something besides instrumentation to offer biological research.

To Dr. Stacy I would suggest that we must not let enthusiasm be interpreted as presumptuousness. In whatever field of biology the biophysicist undertakes research, he must win his spurs. He cannot afford to be a physicist among physiologists and a physiologist among physicists.

Probably for certain purposes we have to be classified and put into pigeonholes, but let's not allow this zeal to prejudice our relationships, limit our interests, or cramp our thinking. The standards of good research are universal.

FREDERICK S. BRACKETT

National Institutes of Health
Bethesda, Maryland

Technical Papers

Source of Atmospheric Salts

Steve G. Boyce

Department of Botany, State College of The University of North Carolina, Raleigh

Evidence at the present time points to the importance of the sea as a primary source of hygroscopic salts in the atmospheric condensation process (*1–3*). These air-borne microscopic particles of salt are the universal condensation nuclei in the formation of rain, fog, and snow. Wind-borne salt spray has also been shown to be responsible for the zonation and spray forms of coastal vegetation (*4–6*). And the main source of soil iodine, absolutely essential in human nutrition, is wind-borne salt spray from the sea (*7*).

The exact source of these salts from the ocean has never been discovered, at least as far as the author was able to determine from literature reviews. Kohler (*1*) assumed that by some selective process salt particles or droplets of one particular size are driven from the sea. In his discussion of the composition of the atmosphere, Clark (*8*) states, "The figures for atmospheric chloride are even more surprising; but they represent in general salt raised by vapor from the ocean." Jacobs (*2*) suggested that the breaking of waves on the shore and the bursting of bubbles produced aerosols by the mechanical dispersion of the liquid. Stuhlman (*9*) has investigated the dispersion of tiny droplets in a gaseous atmosphere by the bursting of small bubbles. In water, bursting bubbles between 0.8 and 2.0 mm in diameter ejected more droplets to a greater height (14 cm) than bubbles either above or below this range. It was also shown that a smaller number of larger drops is projected to lesser heights as the size of the bursting bubble increases, and that the number and height of droplets projected plotted against the size of the bursting bubbles formed a Maxwellian-type curve.

During a study of the coastal vegetation of Brunswick County, N. C., the author had the opportunity to investigate this phenomenon. The first measurements of the landward movement of salts were made with cheesecloth salt traps (*6*). And, as previously shown, there was a decrease in salt concentration with distance from the ocean. However, it is significant that with a wind velocity of 4–6 km/hr, an average of 2.3 mg of salt/dm^2 of cheesecloth was measured in 8 hr

at 270 m from the ocean. This led to an investigation of the dispersion of very tiny droplets into the atmosphere.

Since the cheesecloth traps did not give a measure of the relative size or number of droplets, a salt-sensitive paper was developed. Filter paper, of the 9-cm size, was dipped in 0.01 *N* K_2CrO_4 and air-dried. The dried paper was then dipped in 0.02 *N* $AgNO_3$, subsequently in distilled water to remove the excess $AgNO_3$, and redried. When droplets of sea water fell on the paper, light-yellow spots were formed by the chemical action between Ag_2CrO_4 and the halides of the sea water. The size of the spots is a relative measure of the size of the droplets, but is not a measure of the actual size of the droplets at the moment of impingement on the paper. For comparison of quantitative amounts of salt at each station, the paper was standardized by titration of samples with a known solution of NaCl. The difference between the titration value of the standardized samples and that of the exposed paper was taken as an indication of the quantity of salt caught at each station.

When the salt-sensitive paper was held above the oscillating swash between the breaking waves and the strand, it was almost immediately covered with small spots. These ranged from 4 mm in diameter to barely perceptible dots. When the paper was held above, or just in front of, a breaking wave the spots ranged from 4 to 20 mm in diameter and rarely showed evidence of small dots. It is then immediately apparent that the breaking waves do not disperse an appreciable number of tiny droplets into the atmosphere. It was thought, however, that the tiny droplets ejected into the air by the bursting bubbles of the swash and spume were small enough to be carried by the winds.

By using the oiled glass–slide method of Houghton and Radford (*10*), diameter measurements of air-borne droplets showed a range of 5–200 μ. The means of four determinations, totaling about 800 droplets, were between 35 μ and 55 μ. These droplets are well within the range of fog particles and are therefore easily transported by wind. When the frequencies of these droplets were plotted against diameters, Maxwellian-type curves similar to those of Stuhlman (*9*) were formed. This is considered to be further evidence that the majority of the air-borne droplets originated from bursting bubbles.

To obtain an indication of the area where the greatest quantity of salt became wind-borne, stations were located 5 m apart from the upper strand to beyond the breaking waves. Standardized salt-sensitive paper was thumbtacked to wooden stakes at a height of 50 cm above the strand and the water. Observations were made with a landward wind of 4–6 km/hr and with an outgoing tide.

The papers beyond the breaking waves showed negligible evidence of spray. One paper, when examined under 12-power magnification, showed several dots less than 0.5 mm in diameter. Above and immediately in front of the breaking waves, spots 4–20 mm were formed, with only an occasional dot less than 1 mm in diameter. Above the bursting bubbles of the swash numerous dots were formed, ranging up to 2 mm in diameter, with a mean of about 1 mm. Papers on the strand, 12 m from the highest edge of the water, showed the highest number of dots, but these were somewhat smaller than those of the swash.

Titration with NaCl did not show a significant difference in salt concentration between papers of the strand and those of the swash. This is possibly due to the larger number of smaller droplets caught on the strand. Those above the breaking waves showed the highest salt concentration because of large droplets being pitched by the breaking force of the waves. These droplets are considered to be too large to become air-borne and therefore do not contribute appreciably to atmospheric salts. The papers beyond the waves did not show a perceptible amount of salt. This does not mean that salts become air-borne only over the swash. It is evident that other disturbances on the open ocean which form small, bursting bubbles, such as foam produced by the wake of ships and whitecaps, would also be a source of atmospheric salts.

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Eosinopenic Response of Adrenalectomized Mice to a Cutaneous Application of Cortisone

Robert S. Speirs[1]

Roscoe B. Jackson Memorial Laboratory, Bar Harbor, Maine

Recent experiments have strongly indicated that the eosinopenia occurring over a 4-hr period is a specific response to adrenal cortical hormones. Certain strains of mice have been found to be extremely sensitive to these hormones and have been utilized in a procedure for assaying the 11-oxycorticosteroids (*1–4*). The eosinopenia is produced following subcutaneous, intramuscular, and intraperitoneal injections, as well as oral administration.

The reports of Baker and Whitaker (*5*) and Castor and Baker (*6*) indicated that cortisone produces a local action on the epidermis and connective tissue when applied cutaneously. It became of interest to ascertain whether this method of application also affected the eosinophils. The following report presents

[1] The technical assistance of L. E. Wragg, J. E. Sullivan, and B. Hadley is gratefully acknowledged.

TABLE 1

THE EFFECT OF CORTISONE ACETATE OINTMENT ON THE NUMBER OF CIRCULATING EOSINOPHIL CELLS OF PRETREATED-ADRENALECTOMIZED MICE*

Treatment		Hr after cutaneous application of material																					
		0	1		2		3		4		6		8		10		12		20		30		50		72		96	
		Eosinophil count	Eosinophil count	Decrease (%)	Eosinophil count	Decrease (%)	Eosinophil count	Decrease (%)	Eosinophil count	Decrease (%)	Eosinophil count	Decrease (%)	Eosinophil count	Decrease (%)	Eosinophil count	Decrease (%)	Eosinophil count	Decrease (%)	Eosinophil count	Decrease (%)	Eosinophil count	Decrease (%)	Eosinophil count	Decrease (%)	Eosinophil count	Decrease (%)	Eosinophil count	Decrease (%)
Approximately 100 μg cortisone acetate in 4 mg ophthalmic ointment, applied to 9-cm² area of skin on dorsal region	50 mice	112	51	– 6	82	– 63	51	– 54	43	– 16	53	– 18	31	– 44	58	– 94	22	– 80	20	– 37	0	106	0	276	0	205	0	128	0
		51	71	– 39	19	– 80	10	– 74	8	– 81	31	– 40	37	– 47	25	– 67	47	– 62	187	0	234	0	171	0	124	0	240	0	0
		60	40	– 35	20	– 44	1	– 99	4	– 98	10	– 94	35	– 44	27	– 57	25	– 54	127	0	206	0	182	0	232	0	143	0	0
		43	26	– 11	60	– 91	0	– 100	0	– 100	0	– 100	3	– 91	23	– 75	29	– 49	34	– 73									
		53	52	0	16	– 79	1	– 99	5	– 91	3	– 95	8	– 79															
		31		– 9	6	– 88	4	– 87	0	– 100	7	– 83	23	0															
	Average	58	58	– 10	35	– 37	16	– 66	4	– 90	3	– 94	19	– 62	22	– 60	23	– 53	82	– 28	232	0	210	0	187	0	170	0	0
Approximately 0.1 ml sesame oil applied to the skin on dorsal region	44 mice	33	55	0	147	0	196	0	142	0	198	0	152	0	81	0	114	0	215	0	193	0	119	0	258	0	258	0
		82	69	0	75	0	182	0	295	0	103	0	105	0	98	0	146	0	223	0	240	0	271	0	317	0	177	0
		38	92	– 2	229	– 25	221	– 25	273	0	175	0	134	0	120	– 25	146	0	202	0	214	0					173	0
		58	201	0	75	0	87	0	105	0	250	0	80	0	73	0	32	– 14										
		42	150	0	93	0	66	0	119	0	219	0	427	0			160	0										
					124		64		179		227		58															
	Average	53	51	0	113	0	123	0	136	– 4	195	0	159	0	86	– 6	103	– 2	213	0	216	0	190	0	249	0		

* The eosinophil counts presented here represent actual number of cells counted. To determine no. cells/mm³ of blood multiply by 5.

the results of single cutaneous applications of cortisone acetate on the eosinophils of adrenalectomized mice.

The animals used in these experiments were hybrid mice developed specifically for assaying adrenal cortical hormones. They were the F_1 offspring from a C_{57} Brown/Jax and C_{57} Black/Jax cross. Male mice weighing 20–25 *g* were adrenalectomized in a one-step operation and implanted subcutaneously with a 15-mg pellet of desoxycorticosterone acetate. Four or more days postoperatively the mice were pretreated with 20 μg of epinephrine (adrenalin chloride 1/5,000) and 4 hr later were massaged with either the cortisone ointment or sesame oil. (The ointment used was kindly supplied by F. Homburger.) It consisted of an ophthalmic base containing 25 mg cortisone acetate/*g*. Approximately 4 mg of ointment was applied on a shaved area of 9 cm² on the dorsal side of the mouse. Control mice were handled in the same manner but received 0.1 ml of sesame oil instead of the ointment.

Eosinophil counts were performed in a manner already described in detail (*1*). The number of these cells was determined in 94 mice just prior to the application of the cortisone ointment or sesame oil. The mice were then divided into groups of 3–6 animals, and different groups used for each subsequent count. In the majority of animals only 2 blood samples were taken, but a third sample was obtained from a few animals for the later counts (12–96 hr). Only animals having initial eosinophil counts of 60 or more cells/mm³ were used in this experiment.

The results obtained are tabulated and charted in Table 1 and Fig. 1. It can be seen that there was a marked eosinopenic response following the application of the cortisone ointment. This response began within 1 hr, reached a maximum at 4 and 6 hr and returned to normal after 20 hr. None of the controls showed any consistent decreases of eosinophils.

The data presented here indicate that the effect of the cortisone ointment applied to the skin is first measurable approximately 1 hr after administration and reaches a maximum at 4 hr. This is similar to the results obtained when cortisone is injected into the animals subcutaneously, intraperitoneally, or is given orally (*1, 7*). Additional experiments have indicated that as little as 3 μg of cortisone acetate in oil was effective in producing a marked eosinopenia when applied cutaneously. The cutaneous method of application was approximately as rapid and effective as the normally used subcutaneous injection. This method of application has possibilities for use in screening large numbers of oil-soluble organic compounds for adrenal cortical hormonelike activity. For example, some solvents, such as benzyl alcohol, are extremely toxic when injected subcutaneously or given orally, but have little or no toxic effect when applied cutaneously. Furthermore, only a single tellurite in concentrations that usually inhibit most the material to be screened—is necessary. With this modification it is possible to screen as many as 50 compounds per day with a working group of 4 trained technicians.

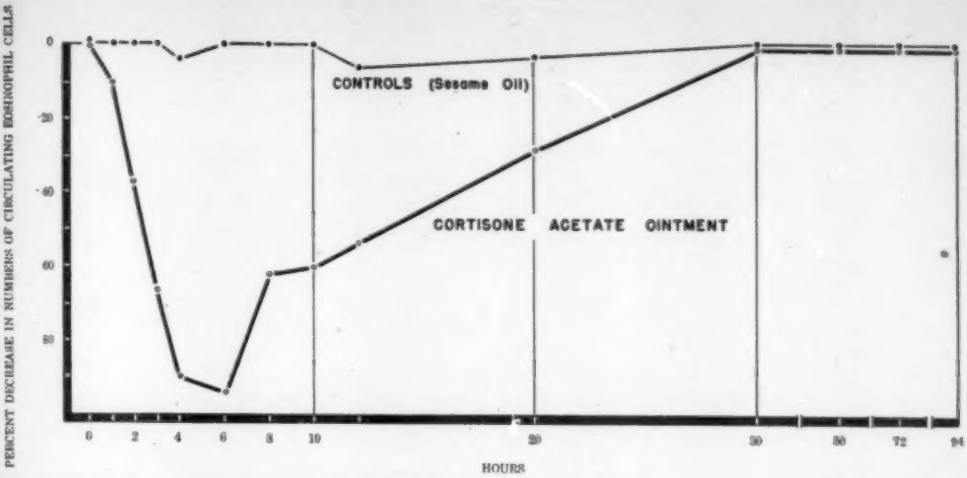

FIG. 1. Percentage decrease in number of circulating eosinophil cells following a cutaneous application of 100 μg of cortisone acetate.

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Isolation of Pleuropneumonialike Organisms from the Throats of Humans

Paul F. Smith[1] and Harry E. Morton

Department of Bacteriology, School of Medicine, University of Pennsylvania, Philadelphia

Because of the frequent association of pleuropneumonialike organisms (PPLO), or L organisms, with a polyarthritis in rats and mice, earlier investigators quite logically looked for these microorganisms in humans exhibiting arthritic symptoms. In mice the conjunctiva, the mucosa of the nose, and occasionally of the trachea, and the brain serve as the habitat of the organisms (*1, 2*). When Sabin and Johnson (*2*) cultured the nose, throat, and conjunctiva of 100 individuals, they failed to find PPLO. In another attempt the above authors examined tonsils removed from 58 children for various reasons. A piece of tissue from each of the 116 specimens of tonsils was minced and then streaked over the surface of 30% ascitic fluid agar plates. In 3 of the 58 cases colonies 20–40 μ in diameter were observed among the bacterial colonies. These small colonies, designated *X* colonies, resembled those of PPLO. Impression smears of these small colonies were unsatisfactory and the *X* colonies never grew in subcultures. The nature of the *X* colonies remains unknown. It is possible that they were PPLO, as it has been observed recently that PPLO will grow in symbiosis with bacterial colonies (*3*).

At the time of their review in 1948, Dienes *et al.* (*4*) stated that PPLO had not been isolated from the human body from areas other than the genitourinary tract except when the individuals had received penicillin therapeutically or when penicillin was added to the culture medium to suppress the growth of bacteria. Dienes *et al.* stated that the PPLO in these cases represented a variant growth form of other bacteria produced under the influence of penicillin.

Smith *et al.* (*5*) discovered PPLO were not inhibited by crystal violet in concentrations that usually inhibit most gram-positive bacteria, nor by potassium tellurite in concentrations that usually inhibit most gram-negative bacteria. By adding both chemicals to an appropriate culture medium both gram-positive and gram-negative bacteria were inhibited, whereas PPLO grew readily. A suitable selective medium for PPLO was described by Morton, Smith, Williams, and Eickenberg (*6*) to consist of the infusion of 50 g Bacto-beef heart for infusion in 1,000 ml distilled water, to which are added 5 g NaCl and 10 g Bacto-peptone. After adjusting the pH to 7.8, 0.013 g crystal violet is added. Following sterilization in the autoclave at 121° C for 15 min, 0.53 ml Bacto-Chapman tellurite solution and ascitic fluid to a concentration of 25% of the final volume is added. This enrichment broth was employed with some of the throat cultures in these studies, but with a majority of the specimens a 1% concentration of a recently characterized serum fraction (*7*) was substituted for

[1] Difco Laboratories fellow in bacteriology.

the ascitic fluid, with appropriate diminution of the inhibitors to give concentrations of crystal violet of 1:100,000 and of potassium tellurite of 1:35,000. As PPLO produce little or no visible growth in liquid media, growth in the enrichment broth has to be ascertained by inoculating the enrichment broth cultures onto the surface of solid medium in Petri dishes. The medium employed for this purpose was that described by Morton, Smith, and Leberman (*8*). A few cultures in which some bacterial growth occurred were subcultured onto the solid medium containing 0.006 g crystal violet and 0.53 ml Bacto-Chapman tellurite solution per liter.

In the case of 11 individuals a sterile cotton swab was rubbed over the tonsillar areas and the posterior portion of the throat. The swab was then placed directly into a tube of 5 ml of enrichment broth and incubated at 37° C for 2 days. Growths in the tubes were inoculated onto Petri plates of Bacto-PPLO Agar, Experimental (*8*), enriched with ascitic fluid and incubated aerobically for 2 days at 37° C. In the case of 103 medical students, the throat swabs were placed in test tubes containing 1 ml of extract broth. After a suspension of the material on the swabs was made in the broth, the swab was discarded, and 0.5 ml of the suspension in each case was transferred to a tube of the enrichment broth. These were then treated as described above.

The Petri dish cultures were examined under the low power of the microscope (100×) for characteristic colonies. Verification of the colonies of PPLO may be made by staining according to the method of Dienes, which has been described fully elsewhere (*6*).

The throat cultures of 6 of the 11 individuals were positive for pleuropneumonialike organisms. In addition, the throat cultures of 32 of the 103 normal, healthy, medical students were positive for PPLO. A total of 38, or 33.6%, of 114 throat cultures yielded pleuropneumonialike organisms. This incidence is lower than that of PPLO in human saliva, PPLO having been detected in the saliva of 46 of 100 individuals (*6*). The colonies of pleuropneumonialike organisms isolated from throat cultures are similar to those isolated by us from the genitourinary tract of humans (*9*) and to a known culture isolated from a human by Dienes and to cultures of human and rat origins furnished by I. G. Schaub, of Johns Hopkins Hospital.

By means of improvements in the cultivation of PPLO, these organisms have been detected in saliva and throat cultures of individuals and in a frequency exceeding that reported for the normal female (*10, 11*) and male (*12*) genitourinary tracts. However, if some pathology exists in the genitourinary tract, the incidence of isolation of PPLO is greater (*10–13*).

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Atmospheric Nitrous Oxide and the Nitrogen Cycle

Arthur Adel

Arizona State College, Flagstaff

The author's discovery of nitrous oxide (*1*) in the earth's atmosphere has received numerous confirmations (*2–4*), both in this country and abroad. The amount present is comparable with that of atmospheric ozone, about 3 mm N.T.P. (*5*).

It was subsequently discovered[1] that nitrous oxide is one of the most abundant constituents of soil air (*7*), whereupon it was suggested by the present author that escaping soil air might well be a principal source of the atmospheric nitrous oxide (*8*).

It is the purpose of this note to summarize several lines of evidence, recently adduced, which lend strong support to this early hypothesis regarding the gas's origin, which make it seem probable that the nitrous oxide "layer" is "adjacent" to the earth's surface, and which strongly suggest the idea that atmospheric nitrous oxide is an important phase in the nitrogen cycle.

a) The effective radiation temperature of atmospheric nitrous oxide is about 10° C, as deduced from observations of the atmosphere's infrared emission spectrum (*9*).

b) A British Admiralty group, investigating atmospheric transmission in the infrared, has found large concentrations of nitrous oxide in air paths parallel and close to the surface of the land and sea (*4*).

c) An inspection of solar spectra recorded aboard high-flying aircraft reveals a greatly diminished absorption by nitrous oxide in the 7.8-μ region (*10*).

d) Finally, a recent mass spectrographic analysis has revealed that in the atmosphere near ground level the concentration of nitrous oxide is about 5×10^{-5}% by volume (*11*).

Apropos of the foregoing evidence, it appears very likely that nitrous oxide escapes from the soil into the atmosphere, and the conclusion cannot be avoided that this escape constitutes an important phase of the nitrogen cycle. It thus becomes clear, for the first

[1] The discovery of nitrous oxide in soil air has been confirmed by Taylor *et al.* (*6*). They find it the most abundant constituent of soil air, constituting more than one fifth, by volume.

time, how nitrogen, captured from the atmosphere and fixed in the soils of the earth, is ultimately returned to the atmosphere at the conclusion of the nitrogen cycle:

a) Nitrous oxide appears in the soil as a decomposition product of the fixed nitrogen compounds.

b) The nitrous oxide escapes into the atmosphere.

c) Nitrous oxide diffusing into the upper atmosphere is decomposed photochemically by $\lambda < 2{,}000$ A into N_2, O_2, and NO; and at these high atmospheric levels NO is also decomposed photochemically into nitrogen and oxygen by $\lambda < 2{,}000$ A.

d) Presumably, the nitrous oxide accumulates above the earth's surface until the rates of accumulation and decomposition are equal.

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An Analog of Vitamin B_{12}

R. P. Buhs, E. G. Newstead, and N. R. Trenner[1]

Research Laboratories, Merck & Co., Inc., Rahway, New Jersey

In the chemistry of the coordination compounds, it is well known that group replacements may occur within the coordination sphere. It also has been established that vitamin B_{12} is a cobalt coordination compound (*1*) which we shall represent as follows:

$$\begin{bmatrix} -- & CN^- \\ Co^{+++} & \\ 0\ 0\ 0 & \end{bmatrix}$$

where the minus signs denote negative charges and the zeros denote a neutral group or groups coordinated to cobalt by dative bonds. All the zeros and minus signs, with the exception of the CN^- ion, may occur in a single molecular aggregate (moiety) or be divided among several molecular aggregates without regard to the number of minus signs and zeros in any one of the several molecular aggregates. Obviously some of these aggregates will be ions. If all the foregoing is the case, the possible existence of analogs of vitamin B_{12} resulting from replacement of the CN^- ion with other ions or uncharged groups may be expected.

Vitamin B_{12} is converted to vitamin B_{12a} by photolysis[2] in acidic solution with evolution of hydrogen cyanide (*2*) or by the catalytic action of platinum and hydrogen in neutral solution (*3*) with evolution of methyl amine and the formation of an apricot-colored intermediate. Subsequent air oxidation of this effects the final conversion to vitamin B_{12a}, which is a weak base of PKa 6.9, as was determined by potentiometric titration. The introduction of the uncharged group H_2O into the complex would produce such a cation. The addition of cyanide ion readily reconverts vitamin B_{12a} to vitamin B_{12}. No detectable amount of cyanide ion was observed in equilibrium with the regenerated vitamin B_{12} in this system when it was examined polarographically. These polarographic results, however, do not preclude the existence of the following equilibrium:[3]

$$\begin{bmatrix} -- & (H_2O) \\ Co^{+++} & \\ 0\ 0\ 0 & \end{bmatrix}^+ + CN^- \underset{}{\overset{K}{\rightleftharpoons}} \begin{bmatrix} -- & CN^- \\ Co^{+++} & \\ 0\ 0\ 0 & \end{bmatrix} + H_2O$$

Vitamin B_{12a} Vitamin B_{12}

but only demonstrate that the concentrations of cyanide ion and of vitamin B_{12a} ion are subdetectable in this type of measurement and that therefore the equilibrium constant, K, must be very large.

In more general form, then:

$$\begin{bmatrix} -- & (H_2O) \\ Co^{+++} & \\ 0\ 0\ 0 & \end{bmatrix}^+ + X^- \rightleftharpoons \begin{bmatrix} -- & X^- \\ Co^{+++} & \\ 0\ 0\ 0 & \end{bmatrix} + H_2O$$

Thus, by using other groups more strongly bound than H_2O, the preparation of analogs of vitamin B_{12} should be possible. This is indeed the case (*4*). We have found it possible to prepare the thiocyanate analog of vitamin B_{12} in which the cyanide ion of vitamin B_{12} is replaced by the thiocyanate ion. As was expected, this new analog of vitamin B_{12} is fully active biologically, thus further multiplying the number of known bioactive forms of vitamin B_{12}.

Vitamin B_{12a} prepared catalytically (*3*) and excess potassium thiocyanate in the molar ratio of 10:1 at a vitamin B_{12a} level of 3–5 mg/ml are allowed to react in water at room temperature for a few hours. A 20-vol excess of acetone is added, and the system held at 5° C for 24 hr; whereupon the thiocyanate analog of vitamin B_{12} crystallizes as dark purple-red needles. Vitamin B_{12} in contradistinction is bright red.

The thiocyanate analog, like vitamin B_{12a}, is microbiologically equivalent to vitamin B_{12}, i.e., 11,000 units/μg by the *Lactobacillus lactis* cup assay (*5*). The thiocyanate analog and vitamin B_{12a} when tested by the *L. lactis* (A) and the *L. leichmannii* "unpro-

[1] We are indebted to G. A. Emerson, M. Zanetti, and M. Bingemann, of the Merck Institute for Therapeutic Research, for the acute toxicity and bioassay work; to D. Hendlin, J. A. Lally, and associates for various microbiological assays; to R. W. Walker for the infrared measurements.

[2] This photolysis was first observed in our laboratories by A. Holland and J. C. Rickards.

[3] J. B. Conn, of our laboratories, has demonstrated polarographically the existence of a mobile equilibrium between vitamin B_{12a} and chloride ion.

tected" (B) titrimetric assay methods (*6*) also respond in a like manner, distinct from vitamin B_{12}. The term "unprotected" indicates that the medium is not protected with reductants (Table 1).

TABLE 1

Sample	Units/μg A*	Units/μg B†
Thiocyanate analog	2,300	6,200
Vitamin B_{12a}	1,800	6,800
Vitamin B_{12}	11,000	11,000

* *L. lactis.*
† *L. leichmannii* "unprotected" titrimetric assay.

Bioassays in rats reveal the same order of activity as vitamin B_{12}. Acute toxicity tests on mice failed to reveal any detectable toxicity at the equivalent level of 3.2 mg of the analog for a 70-kg man. Preliminary clinical reports have indicated that the thiocyanate analog of vitamin B_{12} is fully active for pernicious anemia.

The ultraviolet absorption spectrum of the thiocyanate analog is practically identical with that of vitamin B_{12a} from 6,000 to 2,200A (Table 2).

TABLE 2

	E% at 3,520A	E% at 5,250A
Thiocyanate analog	174	61
Vitamin B_{12a}	174	59

The thiocyanate analog shows an absorption band in the infrared at 4.70 μ characteristic of thiocyanate compounds. Similarly, vitamin B_{12} shows an absorption band at 4.60 μ characteristic of the cyano grouping. Vitamin B_{12a}, on the other hand, shows no absorption bands in the 4–5 μ region (*7*).

TABLE 3

Distribution coefficient	Benzyl alcohol / water
Thiocyanate analog	1.66
Vitamin B_{12}	0.84
Vitamin B_{12a}	0.13

Craig countercurrent studies of the thiocyanate analog show that our material is homogeneous and of high purity. The distribution curve is theoretical with the maxima in the fourth tube of an 8-tube study.

The thiocyanate analog is hygroscopic like vitamin B_{12} and vitamin B_{12a}. The analog is not compatible with ascorbic acid at the level of 20 μg/ml of the analog to 20 mg/ml of ascorbic acid. Decolorization occurs within 24 hr. This is analogous to the observed behavior of vitamin B_{12a}, which also reacts with ascorbic acid, and in contradistinction to that of vitamin B_{12} (*8*).

The properties of the thiocyanate analog of vitamin B_{12} are shared in part by both vitamin B_{12} and vitamin B_{12a} (Table 3). Thus in the ultraviolet and in its reaction with ascorbic acid it resembles vitamin B_{12a}, whereas in the 4- to 5-μ region of the infrared and in its distribution behavior in the benzyl alcohol-water system it resembles vitamin B_{12}. Therefore, in the characterization of a related unknown, care must be exercised to examine as many properties as possible before any reasonably certain conclusions can be drawn regarding its relationship to known vitamin B_{12} analogs.

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Pulmonary Edema and Hemorrhage Induced by Hypothalamic Lesions in Rats[1]

J. E. Gamble and Harry D. Patton

Department of Physiology and Biophysics, University of Washington School of Medicine, Seattle

Pulmonary edema, often fatal, is a puzzling complication in a wide variety of clinical conditions. These include not only cardiovascular and pulmonary diseases but also allergy, thyroid crisis, beriberi, cirrhosis and degeneration of the liver, carcinoma, blood dyscrasias, septicemia, drowning, shock, heat stroke, head injuries, and brain tumors. In experimental animals, pulmonary hemorrhage and edema are reported to follow such seemingly unrelated and nonspecific procedures as epinephrine injection (*1*), thiourea poisoning (*2, 3*), feeding ammonium salts (*4*), insulin shock (*5*), cerebral concussion (*6*), increased intracranial pressure (*7*), intracarotid saline infusions (*8*), cisternal injection of veratrin (*9*), bilateral vagotomy (*10*), ligation of the aorta or compression of the left ventricle (*11*), positive pressure respiration (*12*), hyperthermia plus positive pressure respiration (*13*), and war-gas poisoning (*14*). Although the diversity of the clinical and experimental states leading to pulmonary edema suggests multiple causative mechanisms, a neural mechanism is thought by some to be the common denominator of some types of lung edema. The evidence is mostly indirect, since it is largely based upon the protective effect of autonomic blocking agents, narcotics, or surgical attacks on the autonomic nervous system. There is little uncontested evidence of pulmonary edema produced by peripheral or central neural lesions. The following experiments demonstrate that such a "neurogenic"

[1] Aided by a grant from the Washington State Research Fund for Biology and Medicine.

TABLE 1

Group	No. animals	Body wt (g)	Wet lung wt (g)	$\frac{WLW}{BW} \times 100$	Dry lung wt (g)	$\frac{DLW}{BW} \times 100$	Lung fluid (%)
Acute edema	18	312.0 ± 15.5	3.311 ± 0.229	1.01 ± 0.06	0.447 ± 0.053*	0.176 ± 0.005*	82.04 ± 1.42*
Subacute edema	15	332.2 ± 20.0	2.210 ± 0.137	0.68 ± 0.04	0.459 ± 0.055†	0.140 ± 0.015†	79.32 ± 0.60†
Operation control	72	345.5 ± 7.7	1.500 ± 0.038	0.44 ± 0.007	0.334 ± 0.011‡	0.097 ± 0.002‡	78.10 ± 0.18‡
Hyperthermia operative	13	318.4 ± 14.6	1.694 ± 0.138	0.53 ± 0.03	0.348 ± 0.220*	0.110 ± 0.004*	78.28 ± 0.67*
Diathermy	10	305.1 ± 6.5	1.466 ± 0.108	0.49 ± 0.04§	0.325 ± 0.017	0.107 ± 0.006§	77.53 ± 0.63

WLW = wet lung weight; BW = body weight; DLW = dry lung weight.
* Data on 5 animals. ‡ Data on 50 animals.
† Data on 7 animals. § Data on 8 animals.

edema can be produced in rats by restricted lesions of the brain.

In rats anesthetized with Evipal, electrolytic lesions were placed in the rostral hypothalamus with the Horsley-Clarke stereotaxic instrument. The animals were either observed until they died from the operation or were sacrificed 24 hr postoperatively. The lungs were examined macroscopically, weighed, and either sectioned for histological examination or desiccated to determine the dry lung weight.

Eighteen rats died in less than 24 hr after placement of rostral hypothalamic lesions (acute edema group), and pulmonary pathology was obvious in 15 others sacrificed 24 hr postoperatively (subacute edema group). In addition, lung and body weights were recorded for 72 other rats sacrificed after scattered hypothalamic lesions that did not produce pulmonary pathology. The data for this group (operation control group) serve as controls for the other groups. Hyperthermia, a well-known consequence of rostral hypothalamic lesions, developed in 13 operated animals. The data from this group (operative hyperthermia group) served to control the possibility that hyperthermia causes or contributes to the edema. As a further check, 10 rats were artificially rendered hyperthermic by diathermy. The mean data and their standard errors for all five groups appear in Table 1.

The animals of the acute edema group died 30 min–24 hr after operation. Fourteen died in less than 8 hr; 3 died at an undetermined time during the night; only one survived 24 hr. After recovering from the anesthesia, these animals displayed normal or hyperactive cage behavior and normal respiration for varying periods of time. Some quickening of respiration was usually observed just prior to death, and this rapidly developed into a severe respiratory crisis that shortly terminated in death. In the final stages, there was usually a copious flow of pink-tinged, frothy fluid from the mouth and nostrils. The final crisis usually developed explosively. Animals outwardly normal for several hours after operation suddenly developed tachypnea and dyspnea and died in a few minutes.

At autopsy the lungs were dark-red and appeared swollen; the cut surface exuded fluid. Usually all lobes were involved, but occasionally the discoloration was distributed irregularly. A pleural effusion of 1.5–2.4 ml was found in 7 animals; analysis in one instance revealed a total protein content of 4.2 g/100 ml. Fractional analysis gave values of 3.05 g/100 ml for albumin and 1.53 g/100 ml for globulin.

Table 1 shows that the lung weights of these animals were greatly increased, the mean lung weight/body weight ratio being 2.3 times that of the operation control group. The table also shows that the increased lung weight in the edematous animals was due to accumulation of both fluids and solids, since both the percentage of fluid and the dry lung weight/body weight ratio are significantly higher than in the operation control group. The increased fluid content suggests that increased lung weight is not entirely due to accumulation of whole blood (hemorrhage, congestion), for the fluid content of whole blood is not significantly different from that of the lungs. Only accumulation of a dilute transudate such as plasma, which contains a higher proportion of water than lung tissue does, could account for the increased percentage of lung fluid.

The histological appearance of the lungs of 12 animals in the acute edema group amply confirmed this conclusion. Without exception, severe hemorrhage and edema were found. The perivascular spaces were distended with erythrocytes and/or fluid. The alveoli were similarly distended, with large amounts of fibrous or granular transudate and often erythrocytes.

Table 1 also lists the data on 15 animals classified in the subacute edema group. These rats survived operation and were sacrificed 24 hr later by carotid exsanguination. Most of these animals were depressed and dyspneic at the time of sacrifice and probably would have died if the postoperative observation period had been prolonged. In all instances, however, the depression or dyspnea was preceded by postoperative periods of normal or hyperactive behavior and normal respiration. Macroscopically, the lungs were hemorrhagically discolored, but the distribution of lesions was more often spotty than in the acute edema group. The ratios of both wet and dry lung weights to body weight were significantly elevated over those of the operation control group. The mean percentage of fluid in the lungs was slightly greater than that in the control group, but the difference was not statistically significant. This suggests that the increased weight of the lungs was due largely to an accumulation of whole blood (hemorrhage, congestion) rather than a cell-free transudate, which would have diluted the lung tissue.

Again, this was confirmed by histological examination of the lungs. The alveolar and perivascular transudate was predominantly cellular and therefore differed from that in the acute edema group. Frank hemorrhage was the rule, and transudates, if present, were generally sprinkled with erythrocytes. Since hemorrhage occurred in both groups, it seems not unlikely that it is the initial event. Transudation, when it occurs, may be a secondary event, depending on the degree of respiratory obstruction and capillary asphyxia induced by hemorrhage. This hypothesis requires further study.

The data on the hyperthermic rats were collected to test the hypothesis that fever, induced by the hypothalamic lesions, causes the pulmonary changes. Table 1 contains data on 13 rats with postoperative records of elevated body temperatures ranging from 40.6° to 42.7° C; 9 of these animals died, apparently as a result of the fever. In addition, 10 animals were heated by diathermy to body temperatures of 40°–44.2° C; 7 rats died. Although the lungs of these rats showed mild, uniform discoloration, they were clearly distinguishable from those of the edematous animals. Histologically, the lungs appeared normal save for some congestion; the hemorrhage and transudate characteristic of the edematous groups were conspicuously absent. The lung weights of the hyperthermic animals were only slightly elevated over those of the control animals (Table 1). On the other hand, severe edema and hemorrhage occurred in 3 rats in which the postoperative body temperatures never exceeded 38.4° C, 37.3° C, and 38.0° C, respectively. Thus, hyperthermia is not essential to the development of pulmonary edema and hemorrhage following hypothalamic lesions.

To identify the hypothalamic region, destruction of which caused the lung edema and hemorrhage, the brains of 30 of the 33 edematous animals were sectioned serially. In addition, serial sections were cut from 26 brains of the operation control group. These brains were selected because macroscopic examination suggested that the lesions bordered the critical region. In 26 of the edematous animals there was bilateral damage to the region just overlying the rostral half of the optic chiasm. The center of the lesions was usually a millimeter from the midline and dorsal to the rostral third of the chiasm. The lesions thus occupied what Gurdjian (*15*) has termed the "preoptic region." In 4 other edematous animals the lesions were more caudally placed and were asymmetrical. In each instance, however, one needle puncture had penetrated the midline and bilaterally damaged the periventricular system. This suggests that the executant cell bodies or fibers in their caudal course occupy the region around the ventricle. The localization of the lesions in the control animals demonstrated that neither bilateral damage bordering the preoptic region nor unilateral damage to the preoptic region produced pulmonary edema.

Although the phenomenon described is by definition neurogenic hemorrhagic edema, whether it is neurogenic in the sense that the action is exerted on pulmonary vessels as opposed to the heart remains to be determined. That restricted lesions of the hypothalamus can cause such edema holds the promise that some of the nonspecific edemagenic procedures such as cerebral concussion may be given a unitary explanation.

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Physiological Availability of Dehydro-L-Ascorbic Acid and Palmitoyl-L-Ascorbic Acid[1]

Elmer De Ritter, Norman Cohen, and Saul H. Rubin

Nutrition Laboratories, Hoffmann-La Roche Inc., Nutley, New Jersey

Previous studies of the biological activity of dehydro-L-ascorbic acid (DHAA) involved the use of solutions prepared by oxidation of natural or synthetic L-ascorbic acid (AA). The criteria for assessment of potency in guinea pig tests included cure of scurvy (*1–4*), weight gain (*3*), and increase in serum alkaline phosphatase (*5*). Johnson and Zilva (*6*) and Todhunter *et al.* (*7*) determined urinary excretions after oral dosage to humans. The relative activity of DHAA as compared to AA ranged from 80 to 100% in these tests. Recently, crystalline DHAA has been prepared by Pecherer (*8*) by a modification of the method of Kenyon and Munro (*9*) and made available to us; it was of interest to determine the activity of the pure compound in urinary excretion tests in humans similar to those described by Melnick *et al.* (*10*).

Seven male subjects participating in these tests consumed a self-selected diet, but followed a parallel diet on the 2 consecutive urine-collection days, particularly as regards foods high in AA. Since the diets were not standardized from week to week, considerable

[1] Presented before the Division of Biological Chemistry at the 118th Meeting of the American Chemical Society, Chicago, Ill. Publication No. 215.

variations occur in some cases in the basal excretions, and each basal value applies only to its particular 2-day test. To insure saturation, all subjects ingested 300 mg of AA daily for 3 days, following which the supplement was discontinued or, preferably, reduced to 100 mg for the 2 days prior to collection as well as for the two 24-hr collection periods. The test dose of AA or DHAA was ingested in aqueous solution immediately after the noon meal on the second day. In 4 successive weeks each subject received 2 doses of both DHAA and AA. Since slight losses of DHAA were incurred in warming to 70° to dissolve the crystals in water, the potency of each dose solution of DHAA was determined by assay. Twenty-four-hour urine collections were started after the first voiding in the morning, and urines were kept in the refrigerator in amber bottles containing 5 ml of $5N$ H_2SO_4. Assays of both basal and test urines by the method of Rubin *et al.* (*11*) were begun within a few hours after collection was completed. The summary of the excretion data given in Table 1 shows pure DHAA to be completely available to humans.

TABLE 1

HUMAN AVAILABILITY OF CRYSTALLINE DEHYDRO-L-ASCORBIC ACID

Subject	24-Hour excretion of ascorbic acid in urine								
	L-Ascorbic acid dose (300 mg)				Dehydro-L-ascorbic acid dose (as indicated)				
	Basal (mg)	Test (mg)	Extra (mg)	Extra (%)	Basal (mg)	Test (mg)	Extra (mg)	Extra (%)	
EDR	24	96	72	24	26	165	139	50	(2)*
	48	199	151	50	106	197	91	31	(3)
MW	21	184	163	54	28	130	102	38	(1)
	67	227	160	53	39	241	202	70	(3)
JS	19	138	119	40	24	117	93	35	(1)
	40	177	137	46	42	155	113	41	(2)
FWJ	50	271	221	74	45	102	57	21	(1)
	61	110	49	16	64	177	113	41	(2)
JC†	318	810	492	55	281	732	451	56	(1)
	300	612	312	35	890	1395	505	61	(2)
WK	12	141	129	43	86	263	177	66	(1)
	38	170	132	44	20	180	160	58	(2)
ES	163	378	215	72	15	116	101	38	(1)
	157	358	201	67	98	354	256	93	(2)
		Average ± S.E.		48 ± 4.5				50 ± 5.0	

Availability of DHAA = 104 ± 14% (S.E. of quotient)

* Dose: (1) = 268 mg; (2) = 276 mg; (3) = 290 mg.
† Received three times the indicated dose because of extremely high basal excretions.

Excretions of DHAA as such have been determined after the above doses of AA and DHAA, as well as in the basal urines as shown in Table 2. These data indicate that no appreciable amount of an oral dose of either AA or DHAA is excreted as DHAA. Differences between the average excretions are not statistically significant.

TABLE 2

URINARY EXCRETION OF DEHYDROASCORBIC ACID

Subject	Basal excretion	Excretion after oral dose	
		L-Ascorbic acid (300 mg)	Dehydro-L-ascorbic acid (268 mg)
	Mg dehydroascorbic acid per 24 hr		
EDR	1	25	15
MW	—	20	12
JS	6	19	12
FWJ	21	35	10
JC*	39	30	70
WK	—	52	23
ES	14	40	31
Average ± S.E.	16 ± 6.7	32 ± 4.1	25 ± 8.1

* Received three times the indicated doses.

One of the most widely used solvents for extraction of AA or DHAA is a 3% aqueous solution of metaphosphoric acid. For colorimetric assay with dichlorophenolindophenol, the extract is buffered to pH 3.9 with equal parts of glacial acetic acid and 50% sodium acetate (*11*). When this method is applied to crystalline DHAA, however, low recoveries are obtained consistently, regardless of whether H_2S reduction is continued for 2 hr or overnight. When the DHAA is dissolved in the pH 3.5 phthalate-hydrochloric acid buffer recommended by Kenyon and Munro (*9*), quantitative recoveries are obtained. Table 3 gives a summary of assay values found by 2-hr and overnight H_2S reduction of from 0.1 to 100 mg of a crude preparation in both types of buffer, and similar data for the 2-hr

TABLE 3

COMPARISON OF ASSAY PROCEDURES FOR CRYSTALLINE DEHYDRO-L-ASCORBIC ACID

Sample no.	Amount reduced (mg)	Colorimetric assay with dichlorophenol indophenol			
		Solution in 3% HPO_3 buffered to pH 3.9 with equal parts of glacial acetic acid and 50% sodium acetate		Solution in pH 3.5 phthalate-hydrochloric acid buffer	
		H_2S reduction			
		2 hr (%)	Overnight (%)	2 hr (%)	Overnight (%)
1 (Crude)	100	56	58	88	88
1 "	10	58	58	88	85
1 "	1	57	55	87	88
1 "	0.1	59	58	82	85
2 (Pure)	10	60	—	97	—

TABLE 4

HUMAN AVAILABILITY OF DEHYDRO-L-ASCORBIC ACID METHANOLATE AND OF PALMITOYL-L-ASCORBIC ACID

Subject	24-Hr excretion of ascorbic acid in urine											
	L-Ascorbic acid dose (300 mg)				Dehydroascorbic acid methanolate* dose (353 mg = 300 mg L-ascorbic acid)				Palmitoyl-L-ascorbic acid† dose (700 mg = 285 mg L-ascorbic acid)			
	Basal (mg)	Test (mg)	Extra (mg)	Extra (%)	Basal (mg)	Test (mg)	Extra (mg)	Extra (%)	Basal (mg)	Test (mg)	Extra (mg)	Extra (%)
EDR	63	193	130	43	86	233	147	49	70	236	166	58
LD	184	345	161	54	124	292	168	56	203	316	113	39
MW	90	304	214	71	90	275	185	62	116	195	79	28
RW	50	263	213	71	49	194	145	48	154	283	129	45
NC	171	356	185	62	218	326	108	36	119	300	181	64
EM	138	249	111	37	137	296	159	53	90	262	172	60
ES	240	385	145	48	163	290	127	42	60	249	189	66
JS	127	325	198	66	115	302	187	62	35	217	182	64
WM	204	300	96	32	239	386	147	49	94	273	179	63
			Average	54				51				54
			± S.E.	± 4.9				± 3.2				± 4.5

Availability of DHAA · MeOH = 94 ± 10% (S.E. of quotient)
Availability of PAA = 100 ± 12% (S.E. of quotient)

* Assayed 85% as DHAA = 100% as DHAA · MeOH.

† Assay 97.5% on a moisture-free basis.

reduction of 10 mg of a pure preparation. It is evident that the HPO_3-acetate method is not applicable in the assay of crystalline DHAA. No evidence is available to show that similar losses of DHAA are encountered in the extraction of natural products with 3% HPO_3. It is very likely that natural buffers afford protection to AA and DHAA during HPO_3 extraction. Attempts to compare the two extractants have failed because the phthalate-hydrochloric acid buffer does not provide sufficient protection to reduced ascorbic acid during such extractions and is generally unsatisfactory since it is not a strong enough buffer in many cases to change the color of the indophenol dye from blue to red.

A crystalline complex of DHAA and methanol (1 to 1) has also been described by Pecherer (*8*). This compound (DHAA · MeOH) is of interest because its solubility in water is much greater than that of DHAA. Solution occurs rapidly at room temperature with no loss of potency in either water or 3% HPO_3. In acute oral toxicity tests in mice, DHAA · MeOH was found to be no more toxic than AA or DHAA, the LD_{50} being in excess of 5 g/kg. In a short-term chronic toxicity test, mice tolerated 7 daily doses of 1 and 2 g/kg orally with no apparent toxic effect. The results of a human availability test by the above urinary excretion technique are summarized in Table 4 and indicate complete availability of DHAA · MeOH within the accepted limits of the method.

The availability of palmitoyl-L-ascorbic acid (PAA) to humans has also been determined by the urinary excretion technique, because of the limited scope of previously reported data on its biological activity. Ambrose and De Eds (*12*) found normal serum phosphatase levels after administration of 0.5 mg/day of AA or an equivalent amount of PAA to scorbutic guinea pigs for 5 days, the water-insoluble PAA being fed as a solution in propylene glycol. These tests did not provide rigid proof of the biological equivalence of AA and PAA since it was not determined whether the doses given were suboptimal. Goswami *et al.* (*13*) fed the same equivalent levels of AA and PAA to scorbutic guinea pigs for 2 weeks and found average weight gains of 27 and 28 g, respectively, whereas the negative controls died of scurvy. Although this assay indicated equivalent antiscorbutic activity of the two compounds, the number of animals was limited to 2 for AA and 3 for PAA. It is not stated whether the latter was given as a solid or in solution. In the present human availability test, the PAA was given in the solid form as a suspension in water. Comparative excretions of AA are summarized in Table 4 and indicate 100% availability of the palmitate ester. Since the tests of PAA and DHAA · MeOH were run several months after the DHAA tests, it was considered desirable to repeat the standard dose of AA. Thus, the 3 tests in Table 4 were carried out in successive weeks. It may be noted that the average excretion after AA dosage is in close agreement with the average given in Table 1 for previous tests.

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A Satisfactory Apparatus for Study of Analgesia in Mice

James Y. P. Chen and Harry Beckman

Marquette University Medical School, Milwaukee, Wisconsin

The white mouse is a suitable animal for the study of the threshold to induced pain because if dropped upon a heated surface it will sharply withdraw its paws when the sensation of heat is succeeded by pain, the time lapse before this withdrawal being quite constant in individual animals. The only difficulty in our experience has been to obtain a constant and uniformly heated surface upon which to drop the mouse, a handicap now overcome through the development of the herein described apparatus, which is a modification of an arrangement discussed with one of us (H. B.) by N. B. Eddy, of the National Institutes of Health, who based his method upon that described by Woolfe and MacDonald (*1*).

The apparatus, shown in Fig. 1, consists of a copper teakettle, the large opening of which is sealed with a copper plate and the spout of which is connected with a long glass condenser through a tightly fitted cork and a copper cylinder soldered into the spout. The kettle is heated by a 600-w element operated through an adjustable bimetallic relay system and is about two thirds filled with a mixture of equal parts of ethyl formate and acetone. The mixed fumes from the ethyl formate (bp, 54°–55.5° C) and acetone (bp, 55.5°–55.8° C) are returned from the condenser to the kettle, and the temperature of the soldered-in copper plate in the top of the latter is maintained uniformly at 54°–55° C, which is just the pain temperature threshold of the mouse.

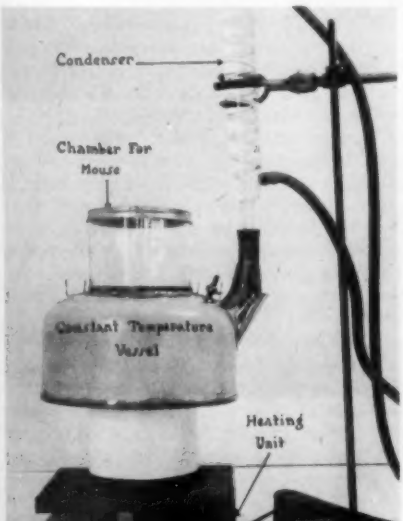

FIG. 1. Apparatus for study of analgesic threshold in mice.

To keep the mouse in contact with the hot plate during "pain-point" determination, a glass cylinder with a cover is fixed on top of the plate. The simultaneous lifting and licking of both forefeet have served us as the most reliable "pain-point," all mice invariably showing this sign within 15 sec after being put on the plate. In our experience any agent deferring the "pain-point" beyond 15 sec may be considered an analgesic.

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Stress and Ketone Body Metabolism[1]

Frederick Sargent II[2] and C. Frank Consolazio[3]

U. S. Army Medical Nutrition Laboratory, Chicago, Illinois

A clue to the role of fat in the metabolic adjustments of man to systemic stress has been provided by a review of data on ketonuria observed during Army ration trials and nutrition surveys. As a part of the nutritional and metabolic assessment of the troops taking part in the trials and surveys conducted in the period 1944–50, specimens of urine were collected for routine testing by one or another modification of Rothera's method (*1*) for detecting the presence of nitroprusside positive substances. The positive reactions, which were identical with those originally described by Rothera (*1*), were qualitatively graded: trace and 1 to 4+. In general the results have been reported as percentages of the tested samples that were positive at any given time (to be called here "per cent ketonuria").

The specimens of urine were collected under a variety of conditions. In the nutrition surveys, the specimens represented random samples. Occasionally similar samples were taken on ration trials. Usually,

[1] The opinions expressed in this paper are those of the authors and do not necessarily represent the official views of any governmental agency.

[2] Present address: Department of Physiology, University of Illinois, Urbana.

[3] To Jack Bollerud, who stimulated our interest in the ketonuria observed during cold weather ration trials, and Everett Bowden, of the Arctic Aeromedical Laboratory, we are indebted for supplying considerable unpublished data on ketonuria occurring during Alaskan ration trials. We wish to thank R. E. Johnson for his assistance in preparing this paper.

however, on such trials specimens were collected according to a fixed plan, which was followed both during the control periods and also when the troops were living in the field under various simulated tactical and survival situations. According to the protocols, 24-hr specimens of urine, two 12-hr specimens per day, or two daily random specimens obtained early in the morning or late in the afternoon were collected from each subject. In all instances the samples were analyzed daily by trained personnel.

The stresses to which the subjects of a ration trial were exposed were not noxious; i.e., they did not cause tissue damage. They were, however, sufficiently severe to require bodily adjustments. When the activities of the trial were those of a simulated tactical situation, three types of stress were encountered: psychological (such as the routine of the trial, living under somewhat primitive conditions, and preparing and eating packaged rations); climatic (heat and cold); and muscular (marching fully equipped over various terrains). In cold climates the exercise also included preparing the camp site, and when on the march the men frequently dragged heavily laden sleds. When a survival situation was simulated, the stress of muscular exercise was not encountered. In the case of nutritional surveys, the chief stress experienced was probably climatic.

A study was made of the occurrence of ketonuria among random specimens of urine collected during nutritional surveys and control specimens obtained from subjects prior to the beginning of various ration trials. The analysis revealed that ketonuria tended to be more common in cold climates (Alaska and Canada) than in temperate or tropical climates (Colorado, Hawaii, and the South Pacific Islands). In six trials conducted in cold climates per cent ketonuria was 0, 6, 6, 8, 12, and 22. In six nutritional surveys and ration trials in temperate and tropical climates, per cent ketonuria was 0, 0, 0, 0, 2, and 2.

During the course of the ration trial, it was found that the daily incidence of ketonuria followed a characteristic curve, which will be designated "curve of per cent ketonuria." Three phases were generally detectable in this curve: low levels during the control period of the trial, an ascent to a maximum a few days after beginning the field period, and a decline to control levels before the termination of the field period. These phases are illustrated in the four curves of Fig. 1.[4] The subjects of these Camp Shilo Trials, who had been acclimatized to the winter climate of Florida, were abruptly transported by air to Camp Shilo, Manitoba, and placed in bivouac under simulated survival conditions. After 12 days in the field, they were transferred to warm barracks for 3 days (recovery phase). The troops performed no regular tactical exercises. The estimated caloric balances for the four groups were: I, −1,770; II, −1,290; III, −1,230; and IV, +840 cal/man/day. Each group subsisted on a different ration. Other details of these

[4] Unpublished data from the Army Medical Nutrition Laboratory.

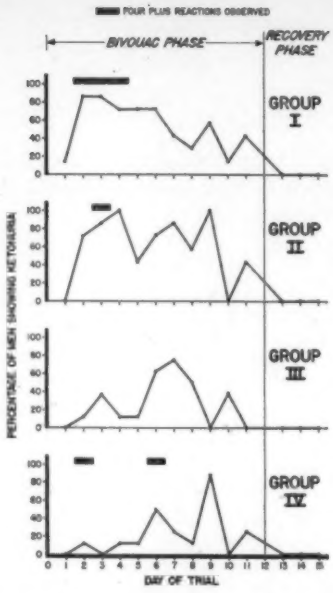

FIG. 1. Percentage of men showing ketonuria each day during Camp Shilo Trials, 1948. The bivouac phase indicates period when subjects were living under simulated survival conditions. During recovery phase men lived in heated barracks. The horizontal bars designate days on which at least one subject excreted urine that tested 4+ by the Rothera method. The estimated caloric balances for the four groups were: I, −1770; II, −1290; III, −1230; and IV, +840 cal/man/day.

trials have been published elsewhere by Bly, *et al.* (*2*).

The time required for the curve of per cent ketonuria to reach a maximum varied in different ration trials from 1 to 8 days. Such a variation was evident in the Camp Shilo Trials (Fig. 1). Analysis of the various data suggested that the caloric balance was one factor governing time to maximum per cent ketonuria. For example, in the Camp Shilo Trials, the more negative the caloric balance, the more rapidly did the curve of per cent ketonuria reach a maximum. When similar troops were exposed to field conditions in successive trials, it was found that there was regularly less ketonuria in the second trial than in the first.

A relationship between ketonuria and muscular exercise was clearly demonstrated in the Prince Albert Trials (*3*). In this trial late-afternoon urinary specimens (collected after a day of marching) more frequently exhibited ketonuria than did morning urinary specimens (collected after a night's rest). In these trials, however, the curve of per cent ketonuria was superimposed on the diurnal cycle attributable to the influence of exercise. That muscular exercise is a cause of ketosis has been established by many investigations (*4–9*). The explanation of this exercise ketosis has not, however, been satisfactorily worked out.

The curve of per cent ketonuria is independent of

the composition of the food consumed and of caloric expenditure. These inferences follow from the fact (*a*) that ketonuria occurred in troops during the testing of a wide variety of rations and (*b*) that ketonuria occurred both when the troops performed hard work and when they did not (as in trials on survival rations). These observations further suggest that depletion of liver glycogen did not occur. What, then, may have been the cause of the ketonuric phenomena? The hypothesis is offered that the curve of per cent ketonuria is an expression of the general adaptation syndrome—i.e., that it represents adaptation to systemic stress (*10*). That cold is the principal stress involved is suggested by the observation that ketonuria is more frequent in cold than in warm climates. Muscular exercise may be a stress involved in some of the trials, for the reduction in ketonuria on exposure to successive trials in which the subjects did work suggests the development of resistance through training. Winkler and Hebeler (*9*) have shown that trained athletes do not develop exercise ketosis. It is also possible that the curve of per cent ketonuria represents the development of a state of crossed resistance (*10*); i.e., adaptation to cold facilitates adaptation to muscular exercise, and vice versa. Furthermore, Selye (*10*) has found that fasting intensifies the alarm reaction produced by many stresses. It may be, therefore, that the inverse relationship between time to maximum per cent ketonuria and caloric balance is an expression of such intensification.

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Book Reviews

Dating the Past: An Introduction to Geochronology. 2nd ed. Frederick E. Zeuner. New York: Longmans, Green, 1951. 474 pp. and 24 plates. $5.50.

This important work, first published by Methuen in 1946, is now available in a new edition, printed in England but bearing an American imprint. Virtually identical with the first edition in number of pages and illustrations, it nevertheless deserves to be called a second edition, for it has been revised with some thoroughness. Several completely new sections (e.g., on radioactive dating of deep-sea cores) have been added; others (such as the paleolithic archaeology of South Africa) have been completely rewritten, and new illustrations and correlation tables substituted for many old ones. It is clear, however, that the revision was accomplished as cheaply as possible—by extensive reprinting from type of the original edition, and by sacrificing perfectly good illustrations in favor of newer but not necessarily better ones. The tempo of research in the subject is partly responsible, along with considerations of economy, for a somewhat scattered treatment: much last-minute information (on radiocarbon dating, the fluorine method, etc.) is included in the Notes rather than in the body of the text, but some of the Notes are reprinted without essential change from the first edition, and others constitute notes on the Notes.

Owners of the first edition will probably not need to buy the new one, but this edition is nevertheless welcome. For those who will now make the book's acquaintance for the first time, a brief appraisal may be necessary. It is, beyond any doubt, an exceedingly useful, interesting work. Professor Zeuner is a tireless bibliographer, and he has covered in a creditable manner the whole enormous range of geochronologic measurement—from tree-ring and varve counting through Pleistocene stratigraphy (with emphasis on paleolithic archaeology) to radioactive estimates of the age of the earth and of the universe. As a sort of annotated bibliography it is invaluable. Even though it does not pretend to be exhaustive, in the field the reviewer knows best (the Pleistocene) there are few references that are pertinent, and hardly any that are significant, that cannot be found by means of this book and the sources it cites.

In other respects, however, the book is not entirely satisfactory. Complete objectivity in reporting so large and controversial a field is probably not attainable, or even desirable, for, where facts are subject to diametrically opposed interpretations, impartiality can mean only dullness and lack of critical acumen. Zeuner's treatment is by no means impartial, but the reviewer is aware that his dislike of some things in the book arises less from its partisanship than from a belief that the partisanship is mistaken. Hence, while *Dating the Past*, like its companion volume *The Pleistocene Period* (London: Bernard Quaritch [1945]), is full of special pleading, it seems a little unfair to condemn it, as an earlier reviewer did, as "a sustained exercise in special pleading." Our knowledge of Pleistocene stratigraphy is so wretchedly inadequate that any attempt to organize it into a con-

sistent picture is bound to look like special pleading to people on the opposite side of the fence.

The uninformed reader may wonder what this is all about. Briefly, Zeuner is an avowed partisan of the "radiation curve" of Milankovitch as a basis for dating Pleistocene events. This curve purports to be a calculation, for any time in the past 600,000 years, of the intensity of solar radiation reaching the upper atmosphere at particular latitudes; its basis is purely astronomic, i.e., the cyclic variations in the relation between earth and sun. The effect on the earth's climate of variations in solar radiation is almost entirely unknown—there are theories aplenty, but few facts. The only empirical evidence that the Pleistocene ice sheets waxed and waned, and that deserts were alternately moist and dry, in rhythm with Milankovitch's curve, is the sequence that Zeuner and a few others think they discern in Pleistocene deposits, particularly river terraces in central Europe. This is a sequence implying not only four glacial ages, recognized by nearly all geologists, but a bipartite character for the first three and a tripartite division of the last glacial age. Evidence for the nine-part, as opposed to the four-part sequence, is totally inadequate, and the radiation curve in Professor Zeuner's hands bears all the signs of a bed of Procrustes.

It would not be profitable, however, to list the many instances in which Professor Zeuner has obviously selected the facts to fit his theory. All of us in science ride our hobbies to some extent, and if he has done so more than most, he has also produced a book that is more than usually interesting, and whose reference value is immense. With a *caveat emptor* that its chief users will probably find unnecessary, *Dating the Past* is warmly recommended.

EDWARD S. DEEVEY, JR.

Geochronometric Laboratory
Yale University

Die Theoretischen Grundlagen der Analytischen Chemie. Gunnar Hägg; German translation by Hans Baumann. Basel, Switz.: Verlag Birkhäuser, 1950. 197 pp. Sw. fr. 18. paper; 22. bound.

Gunnar Hägg, professor of chemistry at the University of Upsala, discusses in this small, lucid book some theoretical aspects of analytical chemistry from an elementary viewpoint. As stated in the preface, the book was designed to fill the gap in the Swedish textbook literature in introductory courses in analytical chemistry. This translation is based on the fourth Swedish edition, which, according to the author, differs only little from the first edition of 1940. The book is by no means as comprehensive as its title implies, almost half of it being devoted to acid-base equilibria discussed from the Brønsted point of view. The remainder of the text deals primarily with precipitation reactions (including a chapter on colloids, adsorption, and ion exchange) and oxidation-reduction reactions. Such modern favorites as colorimetry, spectrophotometry, and polarography are not mentioned.

This reviewer found it particularly interesting that the author made special mention of his reliance on the Brønsted acid-base theory and that he found the use of these concepts pedagogically advantageous—a conclusion with which many of his American colleagues will agree. The consistent use of this concept is partly responsible for the unusual clarity and coherence of the book. Some mention should also be made of the log-log diagrams which are liberally used to demonstrate clearly the properties and meanings of mass action equations. The text has been carefully edited and well translated, and is relatively free from errors. The most serious one is probably the statement (p. 27) that ammonia is more strongly held by ion-dipole forces than water.

The book is reminiscent of a number of American texts on the freshman and sophomore level, particularly those dealing with principles of chemistry, although it is more elaborate than most with respect to acid base equilibria. Typically, analytical problems are discussed only in the last few chapters and there primarily for the purpose of illustrating principles.

KURT A. KRAUS

Chemistry Division
Oak Ridge National Laboratory

Scientific Book Register

Fossil Mammals of Africa: The Miocene Hominoides of East Africa, No. 1. W. E. Le Gros Clark and L. S. B. Leakey. London: British Museum (Natural History), 1951. 117 pp. and 9 plates. £1 15/s.

Organization and Pathology of Thought: Selected Sources. Trans. and commentary by David Rapaport. New York: Columbia Univ. Press, 1951. 786 pp. $10.00.

Culture Worlds. Richard Joel Russell and Fred Bowerman Kniffen. New York: Macmillan, 1951. 620 pp. $6.00.

Bernhard Eduard Fernow: A Story of North American Forestry. Andrew Denny Rodgers III. Princeton, N. J.: Princeton Univ. Press, 1951. 623 pp. $7.50.

The Origin of the Earth. W. M. Smart. New York: Cambridge Univ. Press, 1951. 239 pp. $2.75.

The Structure of Human Abilities. Philip E. Vernon. London: Methuen; New York: Wiley, 1950. 160 pp. $2.75.

Silicate Melt Equilibria. Rev. ed. Wilhelm Eitel; translated from the German by J. G. Phillips and T. G. Madgwick with collaboration of R. B. Sosman. New Brunswick, N. J.: Rutgers Univ. Press, 1951. 159 pp. $5.00.

The New Physics: Talks on Aspects of Science. Sir C. V. Raman. New York: Philosophical Library, 1951. 144 pp. $3.75.

A Source Book in Animal Biology. Thomas S. Hall. New York-London: McGraw-Hill, 1951. 716 pp. $10.00

Ruwenzori Expedition 1934–5: Muscidae, Vol. II, No. 6. F. I. Van Emden. London, England: British Museum (Natural History), 1951. Pp. 325–710, 10 plates. £2 5/s.

Is Another World Watching?—The Riddle of the Flying Saucers. Gerald Heard. New York: Harper, 1951. 183 pp. $2.75.

Association Affairs

Preliminary Announcement
Seventh Philadelphia Meeting
December 26–31, 1951

Raymond L. Taylor, Assistant Administrative Secretary

THE 118th Meeting of the American Association for the Advancement of Science—the annual meeting for the year 1951—will be a well-balanced and full-scale convention. Philadelphia, where the AAAS was founded more than a century ago, in 1848, will be the first city in which the Association has met as many as seven times.

There will be outstanding programs in every principal field of science. All 18 of the Association's sections and subsections and approximately 40 participating societies and organizations are completing plans for a total of more than 200 sessions. The Annual Exposition of Science and Industry, opening 10 A.M., December 27, and closing early in the evening of December 30, is expected to equal the quality of Cleveland's record-breaking show of 1950. Limited to 150 booths, the 1951 exposition will fill the arena of Philadelphia's Convention Hall, which adjoins the campus of the University of Pennsylvania, and will be an important and integral part of the Annual Meeting.

The center of the week's meetings will be Convention Hall and the campus. Convention Hall not only affords excellent facilities for the Science Exposition and the AAAS Science Theatre, but also a large number of session rooms and a Holland-operated restaurant with table service. Close by, the university provides the Irvine Auditorium for large special sessions, laboratories and microscopes for the demonstration sessions of zoologists, the University Museum, and the various schools and departments.

For those who drive, Convention Hall and the campus are particularly convenient because of the abundance of parking space. They are readily reached from downtown hotels by subway, street car, or taxicab, and, in addition, it is planned that special shuttle buses for the 20-block trip will be operated.

Sectional programs in botany, chemistry, dentistry, engineering, geology, history and philosophy of science, medicine, pharmacy, physics, soil science, and zoology, and the symposium of the Oak Ridge Institute of Nuclear Studies on "Radioisotopes and Medicine"—as well as the Biologists' Smoker—are all definitely scheduled for the meeting rooms in Convention Hall. AAAS-sponsored symposia of general interest and some of the special sessions—e.g., the exchange lecture of the BAAS, the illustrated lecture sponsored by the National Geographic Society, and the annual address of the United Chapters of Phi Beta Kappa—are planned for the Irvine Auditorium. Most of the programs of Sections H (Anthropology), I (Psychology), K (Social and Economic Sciences), and Q (Education) will be held in the Bellevue-Stratford, AAAS headquarters hotel, where the Sigma Xi lecture, the annual lecture of the Scientific Research Society of America, and the AAAS Presidential Address and Reception are also scheduled, for the evenings of December 26, 27, and 28, respectively. The sessions of the American Home Economics Association, Biometric Society (Eastern North American Region), National Academy of Economics and Political Science, Phi Kappa Phi, Pi Gamma Mu, Sigma Delta Epsilon, Society of Applied Anthropology, and the Society for Research in Child Development will also be held in the Bellevue-Stratford.

Headquarters of the four zoological societies holding their national meetings with the Association, the American Microscopical Society, Beta Beta Beta, and Alpha Epsilon Delta will be in the Hotel Benjamin Franklin and most of their activities will be centered there. The American Society of Zoologists, besides its hotel sessions, will sponsor four large events on the campus. The Biologists' Smoker, which this society cosponsors, will be the evening of December 29.

The three science-teaching societies—the American Nature Study Society, the National Association of Biology Teachers, and the National Science Teachers Association—which regularly hold their annual meetings with the AAAS, will occupy the Hotel Adelphia completely and will hold all their joint and separate sessions there. It is probable that the sessions of the National Speleological Society will be held in the Hotel John Bartram. Other downtown hotels that have pledged sleeping accommodations for the meeting include the Ritz-Carlton and Sylvania, both near the Bellevue-Stratford, and the Drake, Essex, and Warwick, also centrally located.

Philadelphia, where American science began, has an exceptional number of institutions and industries that should be visited, if at all possible. Among them are the Academy of Natural Sciences; Aquarium; Bartram's Gardens, established in the 18th century; Franklin Institute and the associated Fels Planetarium; Independence Hall and associated buildings, one of which houses the American Philosophical Society; Pennsylvania's University Museum, with one of the world's greatest archaeological collections; and the Zoological Gardens. Local and suburban institutions include Bryn Mawr, Drexel Institute of Technology, Hahnemann Medical College, Haverford, Jefferson Medical College, Philadelphia College of Pharmacy and Science, Women's Medical College of Pennsylvania, Swarthmore, Temple University, and the University of Pennsylvania. Visiting engineers will have unusual opportunities to study the diverse industries concentrated along the Delaware from Wilmington to Trenton.

The Programs

Section A—Mathematics:
Participation in the three-session symposium, "Operation Knowledge;" cosponsorship of program of Biometric Society.

Section B—Physics:
Conferences on problems in pure physics and on applications of physics; a physicists' dinner; an evening session.

Section C—Chemistry:
Two sessions of general papers; a three-session symposium on "Industrial Wastes and Stream Pollution;" a two-session symposium on "Forensic Sciences;" four other symposia on "Recent Development in Catalysis;" "Medicinal Chemistry;" "Organic Chemistry;" and "Petroleum Chemistry."

Section D—Astronomy:
Four or five sessions of contributed papers and symposia.

Section E—Geology and Geography:
Nine sessions, including two-session symposia on "Crystalline Rocks of the Appalachians" and on "Foreign Petroleum Areas."

Section F—Zoology:
Symposium on "Estuarine Ecology," cosponsored by the Ecological Society of America and the American Society of Zoologists.

Sections F and G—Zoological and Botanical Sciences:
A two-session symposium on "Sex in Microorganisms," cosponsored by the American Society of Zoologists, Sections F and G, and possibly other societies.

Section G—Botany:
Five symposia: "The New Jersey Pine Barrens," cosponsored by the Ecological Society of America; "Radiobotany;" "Food and People;" "Recent Developments in Plant Physiology;" and "The Ecology of Disturbed Lands." In addition, Section G plans as many paper-reading sessions as may be necessary to accommodate those botanists who find the Minneapolis meeting inconvenient in time or distance. It is hoped the botanical societies will cosponsor these programs. There will be a botanists' dinner, and the chairman of the section, Ivey F. Lewis, will deliver a traditional vice-presidential address.

Section H—Anthropology:
Thirteen sessions, including joint programs with the Biometric Society, the Society for Applied Anthropology, the Society for Research in Child Development, the University Museum, the American Philosophical Association, Eastern Division; and an anthropologists' dinner.

Section I—Psychology:
Several sessions, including a joint evening program with Section Q.

Section K—Social and Economic Sciences:
Six sessions, including: "Research Opportunities;" "Urban Area Research;" "Behavioral Research;" "Social Physics," jointly with Section M; and a joint session with Section Q.

Section L—History and Philosophy of Science:
Nine or ten sessions, including a symposium on a history of science subject; a joint meeting with the American Philosophical Association; cosponsorship of the program of the Philosophy of Science Association.

Section M—Engineering:
Thirteen sessions. Included are a two-session symposium on nuclear engineering and joint programs with the Philadelphia section of ASME, Philadelphia Engineering Colleges, Section K, and Franklin Institute.

Subsection Nm—Medicine:
A four-session symposium on "Fat Metabolism" (including aspects of arteriosclerosis.)

Subsection Nd—Dentistry:
Three sessions of contributed papers in dental research.

Subsection Np—Pharmacy:
Six sessions, cosponsored by the Scientific Section, American Pharmaceutical Association, the American Association of Colleges of Pharmacy, the American College of Apothecaries, and the American Society of Hospital Pharmacists.

Section O—Agriculture:
Four sessions devoted to "The Public Health Aspects of Soil Science."

Section P—Industrial Science:
This new section will hold its first meetings, including a session arranged by the American Industrial Hygiene Association.

Section Q—Education:
Ten sessions, including joint programs with Sections I and K, and the symposium "Operation Knowledge."

Societies and Organizations Meeting with the AAAS

(Exclusive of those present as cosponsors of sectional programs)

B	American Meteorological Society Oak Ridge Institute of Nuclear Studies
E	National Geographic Society National Speleological Society
F	American Society of Protozoologists American Society of Zoologists Herpetologists League Society of Systematic Zoology
FG	American Microscopical Society Beta Beta Beta Biometric Society, Eastern North American Region National Association of Biology Teachers
G	Philadelphia Botanical Club
I	Society for Research in Child Development
K	American Home Economics Association National Academy of Economics and Political Science Pi Gamma Mu
L	Philosophy of Science Association
N	Alpha Epsilon Delta
P	American Industrial Hygiene Association
Q	AAAS Cooperative Committee on the Teaching of Science and Mathematics National Science Teachers Association
X	Academy Conference American Nature Study Society American Association of Scientific Workers City Planning Commission of the City of Philadelphia Conference on Scientific Manpower Honor Society of Phi Kappa Phi National Association of Science Writers Pennsylvania Academy of Science Scientific Research Society of America Sigma Delta Epsilon Society of the Sigma Xi United Chapters of Phi Beta Kappa

News and Notes

American Philosophical Society

THE AMERICAN PHILOSOPHICAL SOCIETY held its annual meeting in its hall on Independence Square, Philadelphia, on Thursday, Friday, and Saturday, April 19–21. The annual meeting of the Council was held on the afternoon and evening preceding the session on Thursday.

Edwin G. Conklin, president, presided at the Thursday morning session, at which papers were read by George Boas, of Johns Hopkins, on "The Influence of Philosophy on Science;" W. Albert Noyes, Jr., of the University of Rochester, on "Photochemistry as a Tool for the Study of Reaction Mechanism;" Alan J. B. Wace, of Farouk 1 University, Alexandria, on "Excavations at Mycenae 1950;" Aziz S. Atiya, of Farouk I University, Alexandria, on "The Monastery of St. Catherine and the Mount Sinai Expedition;" and T. J. J. See, U. S. Navy (ret.), on "The Hyperbolic Curves for the Stresses of Gravitation in Space Identical with St. Venant's Torsional Stress in Solids."

On Thursday afternoon Herbert F. Goodrich, vice president, occupied the chair for a program of papers by Charles H. Best, of the University of Toronto, on "Studies on Diabetes and Cirrhosis;" Arthur W. Hummel, of the Library of Congress, on "Some Basic Principles in Chinese Culture;" Linus Pauling, of Caltech, on "The Hemoglobin Molecule in Health and Disease;" Walter Kotschnig, of the Department of State, on "Economic and Social Foundations of the United Nations;" and Ephraim A. Speiser, of the University of Pennsylvania, on "The Ancient Near East and Modern Studies of Civilization."

On Thursday evening, Edwin P. Hubble, of Mount Wilson Observatory, gave the R. A. F. Penrose, Jr., Memorial Lecture on "Exploration in Space, the Cosmological Program for the Palomar Telescopes." The lecture was followed by a reception.

On Friday the open sessions were continued, and, with Arthur H. Compton presiding, papers were presented by Burrhus F. Skinner, of Harvard, on "Schedules of Reward and their Effects upon Behavior;" Herbert Heaton, of the University of Minnesota, on "The Industrial Immigrant, 1783–1812;" Zechariah Chafee, Jr., of Harvard, on "Some Problems of the Draft of the International Covenant on Human Rights;" DeCoursey Fales, Jr., of the University of Pennsylvania, on "The Theater at Kourion, Crete;" and Alfred H. Williams, of the Federal Reserve Bank of Philadelphia, on "Money Will Not Manage Itself."

Friday afternoon Waldo G. Leland presided, and papers were read by Alan Boyden, of Rutgers, on "Serological Comparisons of the Sera of Some Mammalia and their Biological Significance;" John F. Fulton, of Yale, on "The Physiological Basis of Psychosurgery;" Farrington Daniels, of the University of Wisconsin, on "Utilization of Solar Energy;" and Quincy Wright, of the University of Chicago, on "Law and International Relations."

The annual dinner was held on Friday evening at the Benjamin Franklin Hotel, about 250 members and invited guests being present. Hu Shih, curator, Gest Oriental Library, Princeton University, gave the after-dinner address. The John F. Lewis Prize of $300 and diploma for an important work that had been reported to the Society and published in its *Proceedings* was awarded to Joseph J. Spengler, professor of economics, Duke University, for his work on "Economic Factors in the Development of Densely Populated Areas."

On Saturday morning the annual business meeting was held, at which these officers and new members were elected: president, Edwin G. Conklin; vice presidents, Herbert F. Goodrich, Waldo G. Leland, Linus Pauling; secretaries, Jacob R. Schramm, Richard H. Shryock; curator, Leicester B. Holland; treasurer, Fidelity-Philadelphia Trust Company; councillors (to serve for three years), Jesse W. Beams, Class I, Ralph W. Chaney, Class II, Henry Allen Moe, Class III, Fred N. Robinson, Class IV. Recommended for membership were 16 residents of the U. S. and two foreign residents, including Winston Churchill.

Scientists in the News

Howard B. Andervont, chief biologist at the National Cancer Institute, USPHS, has been elected to the Board of Scientific Directors of the Roscoe B. Jackson Memorial Laboratory. Other members of the board include **L. C. Dunn,** Columbia University, president; **Frank Beach,** Yale; **Clarence C. Little,** director of the Laboratory; **Richard E. Shope,** Merck Institute for Therapeutic Research; **Homer Smith,** New York University School of Medicine; **Edwin B. Wilson,** vice president of the National Academy of Sciences and professor emeritus, Harvard School of Public Health; and **Sewall Wright,** University of Chicago.

Herbert C. Batson has been appointed professor of biostatistics at the University of Illinois College of Medicine. He previously served as director of the Biologic Products Division of the Army Medical Service Graduate School, Washington, D. C.

Osborne A. Brines, professor of pathology at Wayne University College of Medicine, has been elected vice president of the International Society of Clinical Pathology. Dr. Brines will attend the International Congress of Clinical Pathology in London in July as official delegate of the American Society of Clinical Pathologists.

At the sixteenth Hughlings Jackson Memorial Lec-

ture, held at the Montreal Neurological Institute, the guest speaker was **J. B. Collip**, dean of the Faculty of Medicine and professor of medical research, University of Western Ontario, London. The subject of his address was "The Endocrines in Relation to Neurology."

Herald R. Cox, director of viral and rickettsial research of the Lederle Laboratory of the American Cyanamid Company, has been awarded the Howard Ricketts medal of the University of Chicago. Dr. Cox, for whom the Q-fever microorganism is named *Coxiella Burnetii*, is an authority on immunology of rickettsial diseases and preparations of vaccines. The Ricketts medal, honoring the late University of Chicago physician who died of typhus 41 years ago while working in Mexico City, is a national honor in recognition of outstanding medical work. Established by Mrs. H. T. Ricketts in 1949, the medal has previously been awarded to **Ludvig Hektoen**, University of Chicago professor emeritus of pathology; **Russell Wilder**, Mayo Clinics director of medicine; and **S. Burt Wolbach**, Harvard professor emeritus of pathology.

Arthur C. Emelin has been elected president of Schenley Laboratories, Inc., succeeding the late **Irving J. Seskis. Aaron F. Levy**, a member of the engineering staff since 1935, was named executive vice president. Dr. Emelin has been engaged in the pharmaceutical field since his graduation from Columbia University College of Pharmacy in 1924. He will make his headquarters at the company's production plant in Lawrenceburg, Ind.

Louis B. Flexner has been named professor of anatomy and head of the Anatomy Department at the University of Pennsylvania School of Medicine. Dr. Flexner, a researcher in chemical embryology and fetal physiology, has been with the Baltimore division of the Carnegie Institution of Washington.

Stanley G. Fontanna, deputy director of the Michigan Department of Conservation, has been appointed professor of forestry and dean of the School of Natural Resources at the University of Michigan, relieving the present dean, **Samuel T. Dana**, who will continue on the faculty in a new professorship known as the Filibert Roth University Professor of Forestry. He will teach courses in forest history, policy, and economics and plans to complete a book on forest policy.

Recent visitors at the National Bureau of Standards from abroad included **Walter Frings**, assistant professor, University of Cologne; **Makoto Hashii**, chairman of the board, Tokyo Precision Instrument Co.; **D. F. Galloway** and **Ronald Tilsley**, director and research manager, respectively, of the Production Engineering Research Association of Great Britain; **Louis Henry**, director of the Institut pour l'Encouragement de la Recherche Scientifique dans l'Industrie et l'Agriculture, Brussells; **D. De Meulemeester**, dean of the Engineering College and director of Fiber Research and Testing Laboratories, University of Ghent; **F. J. Lehany**, chief, Division of Electrotechnology, National Standards Laboratory, Australia; and **T. D. Northwood**, assistant research officer, National Research Council of Canada.

Four members of the Italian Fuel Research Station, Milan, whose visit to the United States is sponsored by ECA, also visited the Bureau. They were **Carlo Padovani**, director of the station, **C. Siniramed** and **Alberto Girelli**, chemists, and **M. Veneziani**, engineer. **James Ritchie**, director of the South African Bureau of Standards, recently arrived in the United States, has been visiting the Bureau to study the latest developments in testing for control of quality and standardization in general.

Walter H. Gale, associate professor of aeronautical engineering, has been appointed secretary of the Massachusetts Institute of Technology. Professor Gale will have executive responsibilities for the Institute's program of external relations, including alumni, and development of resources. In addition, he will facilitate the work of the officers, members, and committees of the MIT Corporation. Since 1946 he has been associate professor of aeronautical engineering, budget officer and deputy executive officer of the Department of Aeronautical Engineering, and director of the Summer Session at MIT.

David Grant, of Virginia Beach, Va., has been named director of the American Red Cross National Blood Program and medical director of the American Red Cross, succeeding **G. F. Grant**, of Washington, who has resigned. Dr. Grant will direct all phases of the Red Cross Blood Program, which provides blood for military and civilian needs and civil defense. **Russell Haden**, of Crozet, Va., has been named associate director of the program.

Otto H. Haas, of The American Museum of Natural History, will represent the museum at the Centennial of the Austrian Geological Survey, to be celebrated in Vienna June 12–16. He plans to do some research at museums and universities in France, Austria, Western Germany, Holland, and England.

M. E. Hains, Electron Physics Section, Associated Electrical Industries, Ltd., Research Laboratory, plans to visit various laboratories and universities in the U. S. during September–November.

Harry F. Harlow, professor of psychology, University of Wisconsin, and scientific adviser for psychology, Department of the Army, gave the American Museum of Natural History's twentieth annual James Arthur Lecture on the Evolution of the Human Brain. His subject was "The Brain and Learned Behavior."

Alexander Hollaender, director of the Biology Division of Oak Ridge National Laboratory, was a guest speaker this spring at a conference on the "Use of Tracer Isotopes in Steroid Chemistry and Biological Investigation," in London, sponsored by the Ciba Foundation, to promote international cooperation in medical and chemical research. Dr. Hollaender spoke

on "Mechanism of Chemical Protection Against Radiation."

Joseph P. Holt, of Pine Castle, Fla., has resigned as medical research director of the Medical Department of the Standard Oil Company (N. J.).

Seth Q. Kline has retired at the Army Chemical Center after 24 years of service—since 1940 as a chemical ordnance engineer in the Munitions Division of the Chemical and Radiological Laboratories.

On July 1 **L. Don Leet** will succeed **Marland P. Billings** as chairman of the Department of Geology and Geography and chairman of the Division of Geological Sciences at Harvard. At the same time, **Cornelius S. Hurlbut, Jr.,** will become counsellor of graduate students, and all communications concerning graduate studies should be addressed to him. **Russell Gibson** will become chairman of the board of advisers to handle undergraduate problems.

Clarence H. Lorig, assistant director, Battelle Memorial Institute, received from the University of Wisconsin, at its third annual Engineer's Day, a distinguished service citation for accomplishments in the field of metallurgical engineering. Last year Dr. Lorig was awarded the Joseph S. Seaman Gold Medal for metallurgical research by the American Foundrymen's Society.

Robert B. McConnell is now associated as research geologist with D. Harold Byrd and Affiliates in the companies' Dallas offices.

Paul C. Mangelsdorf, professor of botany and director of the Botanical Museum at Harvard University, delivered the Julius A. Nieuwland lectures in botany for 1950–51 at the University of Notre Dame. The title of the series was "Plants and Human Affairs."

Raymond P. Mariella has been appointed chairman of the Department of Chemistry (Lake Shore Campus) of Loyola University, of Chicago. He will assume his duties next September. Dr. Mariella was formerly assistant professor of chemistry at Northwestern University.

Roy K. Marshall, director of the Morehead Planetarium and professor of astronomy at the University of North Carolina since January 1949, has resigned to return to Philadelphia and devote full time to radio, television, and newspaper work. **Douglas Duke** has been named acting chairman of the Astronomy Department and is the planetarium's astronomical adviser, **W. D. Bulloch** is the producer, and **A. F. Jenzano** manager of the planetarium.

Four young scientists have been awarded fellowships for the study of trace elements at McCollum-Pratt Institute, Johns Hopkins. The E. J. Johnson Post-Doctoral Fellowship was given to **D. J. D. Nicholas,** plant physiologist, of the Plant Nutrition Institute, University of Bristol; the C. F. Kettering Post-Doctoral Fellowship to **Ronald Moss,** plant physiologist, Iowa State; McCollum-Pratt Post-Doctoral Fellowships to **Lazarus Astrachan,** physiological chemist, Yale, and **Leonard J. Zatman,** biochemist, Research Institute of Montreal General Hospital. Dr. Nicholas will study the effect of trace element deficiencies on the enzyme construction of plants; Dr. Moss will work on the general problem of amino acid metabolism under varying conditions of trace element deficiency; and Drs. Astrachan and Zatman will take part in McCollum-Pratt Institute's over-all study of the trace element phosphorus.

Karl F. Oerlein has joined the Weapons Defense Branch of the Armed Forces Special Weapons Project, Washington, D. C., as science education specialist. Dr. Oerlein was formerly on the staff and faculty of the Chemical Corps School, Radiological Defense Branch, Army Chemical Center.

John Thomas Patterson, director of zoological research at the University of Texas, received the Daniel Giraud Elliot gold medal awarded by the National Academy of Sciences at its 88th annual meeting. The Elliot Medal is given annually to the author of a paper on original research in zoology or paleontology judged to be most meritorious and worthy of honor. In presenting the recipient to the president of the Academy, Alexander Wetmore, chairman of the Elliot Fund Committee, cited Professor Patterson's outstanding contributions to genetics, particularly his papers on isolating mechanisms.

Samuel J. Prigal, assistant professor of medicine, New York Medical College, Flower–Fifth Avenue Hospital, has been invited to participate in the "Symposium on Aerosol Therapy," to be held in June under the auspices of Minerva and Italian Medical Societies, at Turin.

Adolph H. Rosenthal was recently elected vice president and director of research and development of Freed Radio Corporation, New York. Dr. Rosenthal, who joined Freed Radio in 1949, was formerly director of physics.

Harold E. Thomas, district geologist of the Salt Lake City office of the Ground Water Branch, Water Resources Division, USGS, recently returned to Washington after a year's leave of absence to perform a specialized ground-water study for the Conservation Foundation in New York City, under the direction of Fairfield Osborn. He will maintain a liaison between the district engineers and geologists of the Ground Water offices in Arizona, Colorado, Nevada, and New Mexico.

George E. Ziegler, director of research at Midwest Research Institute, Kansas City, has accepted the post of research director of the Zonolite Company, Chicago. Dr. Ziegler went to Midwest Research Institute as executive scientist when it was established in 1945. He was appointed director in December 1948.

Colleges and Universities

Harvard and **MIT** will begin a joint program next September aimed at attracting more young people of outstanding ability into the teaching profession. The undergraduate phase will be carried out largely at MIT; thereafter students will take courses at both institutions. During the fifth year they will teach part-time at local high schools under the direction of Harvard's School of Education. The course will lead to a B.S. in general science at MIT and an M.A. in teaching at Harvard.

MIT will offer among its special courses this summer one on Automatic Stabilization and Control of Helicopters, July 9–18; on Aerodynamics—Compressible Fluids, Airplane Stability and Control, Aeroelasticity and Structural Dynamics, June 11–20; and Principles of Instrumentation and Control, July 23–August 31. The Department of Mechanical Engineering will offer a two-week course in Photo-elasticity, under the direction of William M. Murray, August 20–31. Frederick G. Fassett, Jr., is director of the Summer Session.

The summer work in tissue culture techniques at the **Mount Desert Island Biological Laboratories,** Salisbury Cove, Maine, will again be under the supervision of Philip R. White. Interested investigators and students should write to Dr. White at Jackson Memorial Laboratory, Bar Harbor, Maine.

Texas A & M will send a field party under the direction of Leonard W. Wing and Chester Rowell, in cooperation with the Texas Game, Fish and Oyster Commission and the Mexican Department of Forestal, Casa, y Percha, into Tamaulipas, Mexico, for a study of the white-winged dove. They will meet a group of biologists from the Texas Game Commission headed by Pierce Uzzell. Many of the doves present in south Texas during the fall are believed to come up from Mexico, and the project will carry on large-scale banding as part of the study program.

Grants and Fellowships

The **Commonwealth Fund** has given $150,000 to the Health Insurance Plan of Greater New York for a study of family experience in medical care. The appropriation is, however, conditional upon receipt of a like sum from another source.

William Bayard Cutting Traveling Fellowships have been awarded by Columbia University to five graduate students for research along the Amazon in Brazil, and in Rome, Tokyo, England, and Germany. Most of them are continuation fellowships.

Eastman Kodak Company fellowships for advanced studies in chemistry, have been put at the disposal of the following colleges and universities: Rochester, Chicago, Cornell, Illinois, Iowa State, Nebraska, California (Los Angeles), Harvard, Penn State, and Texas; for chemical engineering, MIT and the University of Michigan; and for physics, Caltech, Ohio State, and Princeton. Selection of the student is made by each university.

Caltech has initiated a new form of scholarship for summer graduate students in the Division of Biology —to be known as **McCallum Summer Scholarships.** The McCallum Foundation, of New Brunswick, N. J., established by Mr. and Mrs. Arthur McCallum, provided the funds.

Bakelite Division of Union Carbide and Carbon Corporation has established a one-year fellowship in polymer chemistry at Wayne University. Holder of the fellowship will work under the direction of William J. Bailey, of the Department of Chemistry.

Bausch & Lomb Science Scholarships at the University of Rochester have been received by Karl Berkelman, Lewiston, Maine; Dorothy Ann Botkin, of Croton-on-Hudson, N. Y.; and Alvin J. Clark, of Westfield, N. J. Six others among the 20 finalists, who were chosen from nearly 900 applicants in the U. S., Puerto Rico, and Alaska, won scholarships of comparable value at the university.

Carnegie Summer Fellowships for interdisciplinary study in the social and biological sciences have been awarded to A. J. Brodbeck, of the Department of Psychology of Boston University, and Joseph J. Antonitis, of the University of Maine. With money provided by the Carnegie Corporation of New York the Roscoe B. Jackson Memorial Laboratory will provide similar fellowships for summer study at Bar Harbor during the next four seasons.

The **National Tuberculosis Association** has granted research fellowships to Glen R. Gale, Duke University; A. M. Dannenburg, Jr., Henry Phipps Institute; Helen Wago, New York University; Oscar J. Balchum, National Jewish Hospital, Denver; James G. Hirsch, Rockefeller Institute for Medical Research; Quentin N. Myrvik, University of Washington; Ralph G. Spears, Northwestern; and Loren Winterscheid, University of Pennsylvania.

Research Corporation has given a Frederick Gardner Cottrell grant to Brandeis University for support of the work of Saul G. Cohen on fundamental reactions of free radicals in solution. Dr. Cohen occupies the Rita H. Aronstam chair in chemistry and has recently been named a member of the Advisory Panel to the Weizmann Institute of Science, Rehoveth.

The Hahnemann Medical College has received a **USPHS** grant to the Department of Bacteriology for studies on penicillin-resistant staphylococci, and the Department of Medicine has received a grant from **E. R. Squibb & Sons** for the study of pain-relieving drugs in arthritis, from **Commercial Solvents Corporation** for a study of glucuronic acid in arthritis, and from **Wyeth Inc.** for clinical research.

The **Office of Naval Research** has awarded a con-

tract to the Kirksville College of Osteopathy and Surgery for research on chronic segmental facilitation and the exchange between the somatic and autonomic nervous systems, under the direction of I. M. Korr, head of the Department of Physiology. This grant is the third from federal agencies to the department, two grants of $10,000 each having been made by the Public Health Service.

Consolidated Natural Gas System Educational Foundation has given $10,000 to Lehigh University to augment the J. D. Berg scholarship fund, established last year by Mrs. Berg in honor of her late husband, former chairman of the Dravo Corporation and corporate trustee of the university. The fund provides for an annual engineering scholarship at Lehigh.

The **Fund for Adult Education** has named Iowa State College as the recipient of a series of grants totaling $260,000 for the development of experimental television programs and for the purchase of television equipment. The grants have been made specifically for activities of WOI–TV, but they will also affect a large number of other departments of the college. It is expected that considerable attention will be given to the exploration of the use of films and the development of forum- and discussion-type programs in education.

The **Guggenheim Foundation** has appointed seven new Jet Propulsion Fellows, selected on the basis of their technical ability, interest in rockets and jet propulsion, and demonstrated leadership qualities. They will work at Princeton and Caltech.

The **John Hay Whitney Foundation** has awarded "Opportunity Fellowships" ranging from $1,000 to $3,000 to 53 persons for the continuation of study or for creative work in 22 fields. They were given to American citizens from Guam, Puerto Rico, Hawaii, the Canal Zone, the District of Columbia, and 16 states, who, "because of arbitrary barriers such as race, cultural background or region of residence, have not had the fullest opportunity to develop their abilities."

The **Washington (D.C.) Academy of Sciences** invites nominations of younger scientists (under 40 years of age as of December 31, 1951) to be considered for the annual bestowal of its scrolls "awarded for noteworthy discovery, accomplishment, or publication in the physical, biological, and engineering sciences, and in the teaching of science." Eligibility for each of the four awards is limited to persons who are either members of the Washington Academy (resident or nonresident) or resident members of a society affiliated with the academy. Most of the scientific, engineering, and technical societies in the District of Columbia are affiliated. In proposing a candidate, it will be helpful to include a brief biographical sketch, an account of his (or her) principal contribution to science, and a list of the candidate's publications. Nominations should be submitted to the general chairman of the Committees on Awards, George P. Walton, 6318 33rd St., Washington 15, D. C., by the end of *November 1951*.

In the Laboratories

As part of its long-range expansion and diversification program, **Schenley Industries** has organized a Facilities Division, of which Brig. Gen. E. F. Jeffe will be in charge.

The **Transandino Company**, Palo Alto, Calif. (R. C. Gill Laboratory for Curare Research), has obtained the services of Frank Sevigne as technical director of its laboratory and production activities. Mr. Sevigne was until recently laboratory director of Collett-Week-Niebecker, of South San Francisco. Transandino's former technical director, George I. Dundas, is now vice president of Transandino, and also of Gill, Dundas, and Company, a newly formed organization devoted to consultative and distributive service for anesthesiology and allied fields.

MIT's new Hydrodynamics Laboratory and Ship Model Towing Tank will be dedicated on June 4 at the opening session of a three-day symposium on "Hydrodynamics in Modern Technology." Among the speakers will be Lewis A. Pick, H. E. Saunders, Karl E. Schoenherr, Forrest Nagler, and Wesley R. Nelson. Karl T. Compton, chairman of the MIT Corporation, will speak on "Engineering Manpower Trends."

Massachusetts General Hospital has recently dedicated its new $2,750,000 Research Building, funds for which were supplied by the National Cancer Institute, National Heart Institute, and by public contributions. As part of the dedication program, Sir Charles R. Harington, director of the National Institute for Medical Research, London, delivered the Edward Pierson Richardson Lecture on "Twenty-five Years of Research on the Biochemistry of the Thyroid Gland."

Eli Lilly and Company plans to start immediate construction of a new antibiotics manufacturing plant on recently acquired land near Lafayette, Ind. The new plant, to be located on a 370-acre plot on the banks of the Wabash, will be named the Tippecanoe Laboratories.

Gulf Oil is building a $1,100,000 chemical research laboratory in Harmarville, near Pittsburgh, Pa. Three sections of the Chemistry Division—product development, analysis, and organic synthesis—will occupy the new facilities, making available additional space for the Physics, Materials and Production Chemistry, and Engineering divisions.

Armour Research Foundation has sent five U. S. scientists to the Monte Verde plantation in Costa Rica to start field work on Manila hemp production techniques, on modifying and improving machinery, and on new ways to utilize waste products. The project is sponsored by the RFC and will be directed by Norton F. Gurley, assisted by Walter J. Armstrong, Nevin M. Hochstetler, Ralph E. Peck, and Landry R. Miller.

Hampered by inability to obtain satisfactory supplies of laboratory animals for an extensive research program in nutrition, a group from the **Emory W. Thurston Laboratories** has launched the Pacific Animal Farms on property recently purchased in Gardena, Calif. The principals are H. B. McWilliams, B. H. Ershoff, and Mr. Thurston. In addition to their own program of nutritional studies, the Thurston Laboratories are engaged in extensive research for the Committee on Food Research, U. S. Army Quartermaster Corps, Food and Containers Institute, the Atomic Energy Commission, and the U. S. Navy.

Formation of a Canadian subsidiary and financial interest in a major new chemical plant at Cornwall, Ontario, have been announced by **Chas. Pfizer & Co., Inc.** Donald Hilton, director of foreign sales for Pfizer, is president of Pfizer Canada, Ltd. The firm will handle Canadian sales of terramycin, and other Pfizer-labeled products. The new plant at Cornwall will be erected by Kemball Bishop, a British-controlled Canadian firm in which Pfizer has a substantial investment.

The **Raytheon Manufacturing Company,** of Waltham, Mass., has transferred its New York and International Sales Offices to 19 Rector St., New York 6.

J. M. Crismon and George A. Fiegen, **Stanford Medical School** physiologists, will head a project at the University, aimed at discovery of potential substitutes for blood plasma, under a contract from ONR.

Recent Deaths

Emmett P. Barnhart (63), animal industry expert, Providence, R. I., May 8; **Robert G. Baxter** (70), mechanical engineer, Philadelphia, May 5; **John L. Blakeley** (51), consulting chemist, New York, May 7; **Alfred F. Bliss** (36), physiologist, East Quogue, L. I., N. Y., May 16; **Gilbert Ames Bliss** (75), mathematician, Harvey, Ill., May 8; **James R. Bloss** (69), obstetrician, Huntington, W. Va., Apr. 21; **Adolph Bonner** (77), gynecologist, Miami Beach, Fla., Apr. 19; **John Hood Branson** (75), high school science department head, Bronxville, N. Y., May 6; **Earle Nelson Burrows** (68), civil engineer, Ithaca, N. Y., May 6; **Leon Campbell** (70), astronomer, Cambridge, Mass., May 10; **Hulsey Cason** (58), psychologist, West Palm Beach, Fla., Apr. 30; **John R. Cautley** (67), aviation engineer, Martinsville, Ind., Apr. 24; **Sumner H. Compton** (50), mining engineer, of Seattle, Wash., Caracas, Venezuela, May 9; **Bowman C. Crowell** (72), pathologist, Clermont, Fla., Apr. 26; **Roy W. Crum** (66), highway engineer, Washington, D. C., May 13.

Orville Estes Day (47), placement officer for the blind, Harrisburg, Pa., May 16; **J. Lee Deen** (54), forester, Fort Collins, Colo., Apr. 24; **William Meddaugh Dunning** (82), eye, ear, nose, and throat specialist, Bronx, N. Y., May 11; **Pedro L. Farinas** (58), radiologist, Havana, Cuba, Apr. 26; **Howard P. Fischbach** (66), physician and surgeon, of Cincinnati, Flathead Lake, Mont., Apr. 22; **Russell T. Fisher** (59), authority on cotton, Quincy, Mass., Apr. 24; **Alice V. Flather** (86), chemist, Nashua, N. H., May 13; **Earl W. Fuller** (65), psychiatrist, Morris Plains, N. J., May 16; **Edward B. Gresser** (53), eye specialist, New York, Apr. 28; **M. Moisevich Gubergrits,** Russian physiologist, Kiev, May 11.

Sir Basil Hall (75), physician, Surrey, Eng., May 16; **Stafford L. Hamm** (69), exploration mining engineer, New York, May 11; **Henry H. Hazen** (71), dermatologist, Washington, D. C., May 1; **Robert H. Herbst** (73), urologist, Highland Park, Ill., May 15; **Jesse M. Howell** (66), G–E works manager, Schenectady, N. Y., May 6; **George B. Ireland** (75), Taylor Instrument Companies, Rochester, N. Y., May 17; **Frederick L. Jack** (90), aural surgeon, Boston, May 3; **James Coyle Kennedy** (57), civil engineer, New York, Apr. 24; **Horace W. King** (77), hydraulic engineer, Pasadena, Calif., Apr. 22; **Robert N. King,** market research expert, Westport, Conn., May 12; **Stanley King** (67), president emeritus, Amherst, Martha's Vineyard, Mass., Apr. 28; **William E. Kistler** (66), physician, Swarthmore, Pa., Apr. 24; **G. A. R. Kon** (59), chemist, Manchester, Eng., Mar. 15.

H. O. Lathrop (63), geographer, Normal, Ill., May 11; **Henry J. Lawton** (37), consulting engineer, Philadelphia, May 4; **William R. Lyon** (56), Bell Telephone Laboratories engineer, East Orange, N. J., Apr. 22; **Margaret T. Madeira** (61), welfare worker, Haverford, Pa., May 3; **Isaac Mark, Jr.** (50), consulting engineer, Rockville Centre, L. I., N. Y., May 15; **Adolph F. Marquier,** pharmacologist and chemist, South Orange, N. J., May 14; **Herbert Adolphus Miller** (75), sociologist, Asheville, N. C., May 6; **Earle G. Morgan,** mining engineer, Lansdowne, Pa., Apr. 20; **George Mueller** (83), surgeon, Chicago, May 7; **Takashi Nagai** (43), x-ray research expert, Tokyo, May 1; **Axel W. Persson** (63), archaeologist, Upsala, Sweden, May 8.

Frederick Raiser (42), electrical engineer, New York, May 11; **Nicholas S. Ranso** (55), surgeon, Long Branch, N. J., Apr. 25; **William H. Rasche** (76), descriptive geometrist, Blacksburg, Va., May 9; **Walter H. Scherer,** dentist, Houston, May 12; **Bernard F. Schreiner** (64), cancer specialist, Buffalo, N. Y., May 8; **David C. Scott** (66), authority on textiles and rubber, Providence, R. I., May 12; **James A. Seaman** (61), urologist, Springfield, Mass., Apr. 21; **Abraham Shorr** (60), eye, ear, nose, and throat specialist, New York, May 14; **James Dutton Smith** (76), physician, Huntington, L. I., N. Y., Apr. 21; **Richard E. Sperry** (65), civil engineer, Princeton, N. J., May 10; **William L. Sullivan** (54), chemical and metallurgical engineer, Bloomfield, N. J., Apr. 23; **Humphrey Sumner** (57), historian, Oxford, Eng., Apr. 25; **H. C. Temple** (93), physician, Alliance, Ohio, May 8; **Charles G. Van Brunt** (81), analytical chemist, Schenectady, N. Y., May 2; **Elmo S. Watson** (59), journalist-educator, Denver, May 5; **Barzillia R. West** (76), dental surgeon, Philadelphia, May 16; **Susan Burridge Wilson** (55), Army nurse, Bennington, Vt., May 16; **Tadaoki Yamamoto** (69), professor emeritus, Waseda University, Tokyo, Apr. 21; **Michael G. Yatsevitch** (71), metallurgist, Cambridge, N. Y., May 9.

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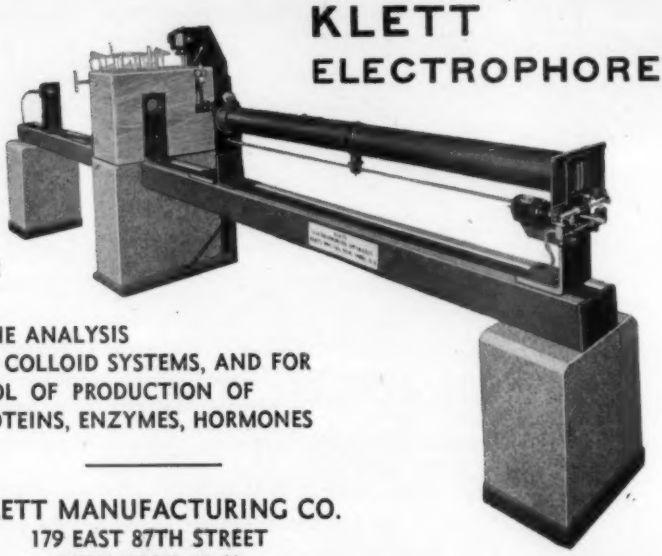

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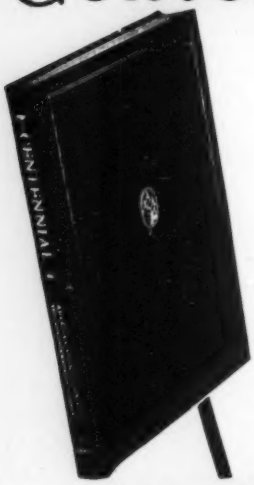

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